Marine Review

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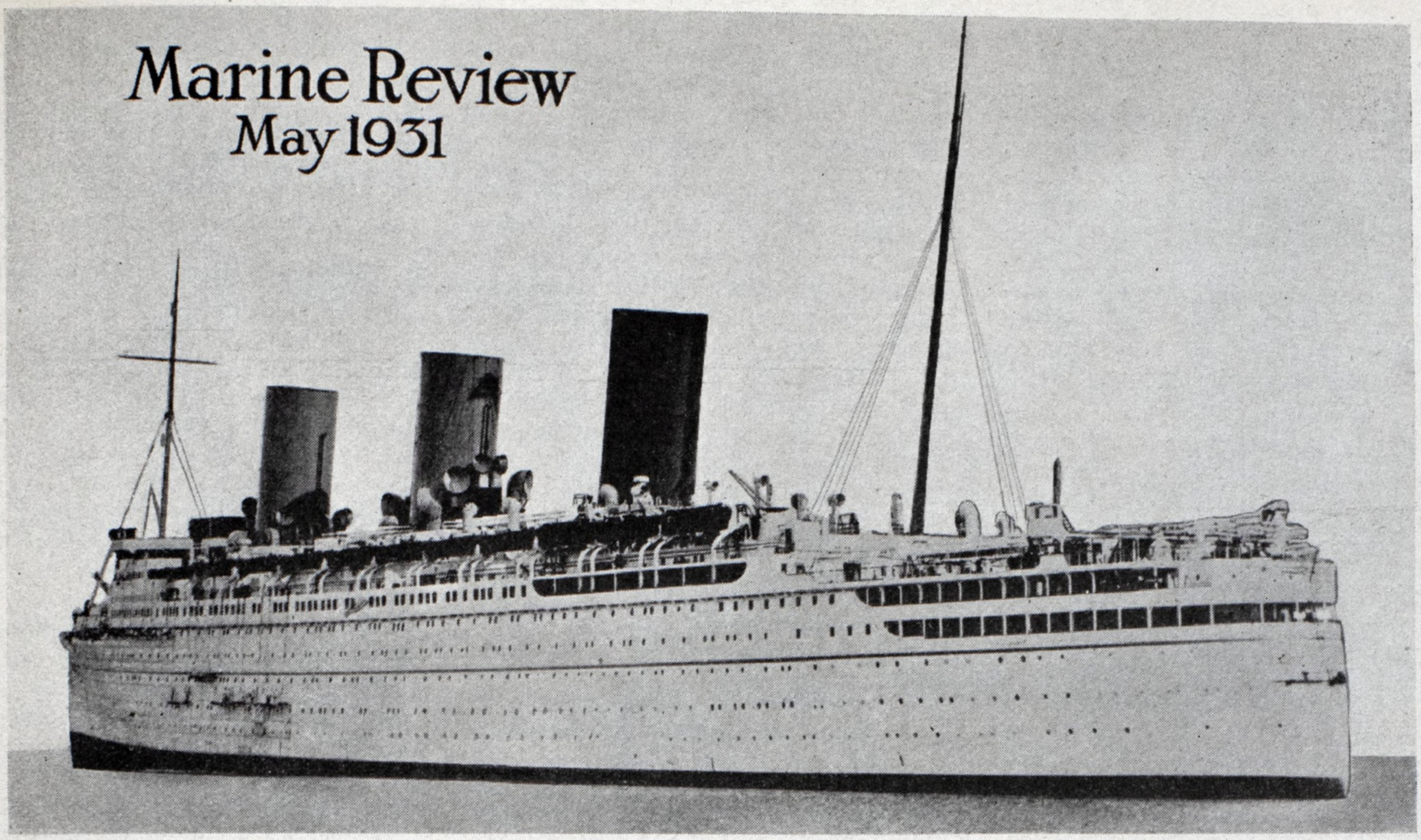


Canadian Pacific Liner Empress of Britain at John Brown's Clydebank, Scotland *(See Page 35.)*

BRITISH SEA POWER

BRITISH Sea Power, 1900-1930, is the title of an interesting paper prepared by Sir Archibald Hurd and presented at the spring meetings of the Institution of Naval Architects. An abstract of this paper follows: Since the opening of the century British sea power has suffered an eclipse and this paper is intended to examine the character of that eclipse. At the time of the South African war there was no power or combination of powers prepared to try conclusions with the mighty naval forces which the British Empire supported. It led the world in the design and building and cheapness of construction of men-of-war even to such an extent that foreign nations ordered ships of this character from British shipyards. In large armored ships the British fleet was above the two power standard which at that time meant the navies of France and Russia.

At this period the author points out the British fleet pervaded the seas and oceans of the world. It was in fact so strong in ships and men that it could afford to dissipate its forces far and wide. The trader and the shipowner knew that nothing untoward could happen without some British naval ship speedily coming to the rescue. The fleet was regarded as the support of diplomacy and trade. In this period the British fleet reached its maximum development, the author thinks, as an agent of civilization standing impressively on guard on all the trade routes, supporting the standard of culture to which the country had attained, checking piracy, suppressing slavery, and charting the great maritime highways of the world's commerce. So the author believes the South African war was vindication of British sea power —the ship of war and the ship of commerce.

All this had its effect on United States, Japan and Germany. The race began between Great Britain and Germany for naval supremacy with the United States and Japan developing their strength outside of European waters. In the summer of 1914 the British fleet assumed command of the sea which in spite of submarine and

mine proved to be the essential factor in the victory. At an enormous sacrifice the British people had made themselves supreme on the sea in a military sense and action at sea was their traditional role. But in addition, for the first time in history, they were also called upon to mobilize as a great military power and finally had to put 10,000,000 men under arms on shore, to furnish munitions to their own as well as allied armies and navies, to act as the financiers of their partners and to supply them with sea transport.

Then came the Washington conference for the limitations of naval armaments. Agreement was reached for equality of tonnage in capital ships for the United States and the British Empire, and failure to agree to apply these ratios to cruisers and other auxiliaries, it being contended that on account of the world wide responsibilities of the British fleet more cruisers were needed than for any other country. This position was generally maintained at the conference at Geneva in 1927. At the London naval conference in 1930, however, this attitude was abandoned and equality with United States in cruisers and other auxiliary vessels was agreed to by treaty. The author suggests that it may have been wise to go on without reference to United States or Japan, the latter at that time a British ally.

The British Merchant Navy

Returning to the merchant navy the author states that it as well as the Royal navy has suffered a partial eclipse since the beginning of the present century and that the cause has been much the same. Other nations have awakened to the value of sea carrying power as an auxiliary to sea figthing power and as an economic instrument. This the author believes goes some way to expose the motives of the Americans. Narrow nationalism has supported the suggestion that each country should carry, if not all at any rate a larger proportion of its seaborne trade, as though it were possible to differentiate between the claims of the buyer and the seller of goods in the matter of transport. A deaf ear has been turned to the impregnable truths that the seas are all one and that the greatest good of the greatest number lies in freedom of access to the world's freight markets with efficiency and cheapness of service as the basis of a healthy competition on the important trade routes, even if, at a heavy cost to producers and consumers, a coastal trade be reserved to the national flag.

Whatever the causes the British merchant navy has suffered a partial eclipse because other nations have added to their merchant fleets by various expedients which may be loosely described as navigation laws.

It is a misconception, the author points out, to believe that the British navigation laws of past centuries were the foundations of this country's predominance at sea at the beginning of this century. At one time these laws may have served a useful purpose because of the conditions prevailing when they were enacted, but by the time of their final repeal in the middle of the last century the British merchant navy, exempt for many years from healthy competition, was languishing. The ships were for the most part badly found, badly navigated and badly manned. The fortunes of British shipping were at a low ebb. The impetus that came from competition was apparent in the growth of the merchant navy after the repeal of the navigation laws, and British tonnage nearly trebled between 1835 and 1874.

In the latter years of the nineteenth century the merchant navy vindicated its position as an international instrument of sea transport, in 1900 accounting for 45.7 per cent of the world's tonnage with its 8914 vessels of 13,241,000 tons gross.

At this period British shipowners were carrying, (1). Practically the whole of the coasting trade of the United Kingdom. (2). Ninety per cent of the trade between the United Kingdom and the Empire. (3). More than one-half the trade between the United Kingdom annd foreign countries. (4). About one-half of the remaining trade of the world.

The British merchant navy came out of the war with loses aggregating 7,830,855 tons and without adequate funds for making good these losses except by drawing on pre-war reserve. Sir Norman Hill has calculated that the replacement cost exceeded the insurance money received by £137,000,000. Crippled by the war the British shipping industry has done little more than replace tonnage destroyed. Expansion has been checked by the mistaken policy of successive chancellors of the exchequer during and after the war. The growth of merchant navies of other countries on the other hand has proceeded at accelerated pace.

Present British Merchant Marine

In considering the position of the British merchant navy today there are three notable developments which cannot be ignored: (1) In 1900 there were no motorships. Today motorships are of 7,816,000 tons gross, which is 11.2 per cent of the total tonnage existing. Of this motorship tonnage 2,421,000 tons, or 10.3 per cent, of the British tonnage, flies the British flag, while 11.7 per cent is under foreign flags, suggesting that British shipowners have been less quick than some of their rivals to adopt this new means of propulsion. (2) In 1900 there were 6,588,000 tons gross of sailing ships which was 22.8 per cent of the total tonnage; there were 2,112,000 tons, or 14.8 per cent under the British flag, and 4,476,000 tons, or 30.2 per cent, under foreign flags, a proof that British owners were adopting steam propulsion more rapidly than their foreign competitors. (3) In 1900 there were practically no tankers. In 1930, 7,536,000 tons gross, or 10.8 per cent of the tonnage afloat, were tankers. Of the British tonnage 2,402,000 tons or 10.3 per cent were tankers, and the foreign tonnage 5,134,000 tons, or 11.1 per cent.

With reference to the merchant navy the author points out conditions are abnormal, owing to the direct or indirect state aid in the United States, France, Italy and other foreign countries. There is no suggestion that these foreign ships are needed because there is already too much tonnage of all descriptions afloat with the result that more vessels of every nationality are idle than ever before. How long this policy of spoon-feeding will be pursued at the expense of the tax payers of the countries concerned, it is impossible to foresee. There is no precedent to aid in forecasting the course of events. Nationalization of shipping having proved a conspicuous failure, another experiment is being tried—subsidies.

He then goes on to say if state aided shipbuilding persists other countries may be forced by their own necessities to fall into line with those who are denying the first principles of the economic law which in earlier years of this century were honored everywhere.

There is one last and permanent factor. The people of Great Britain and Ireland, as islanders, are shipmen, living at the center of a worldwide oceanic empire, a people of great traditions as well as great skill and experience in the designing, building and manning of ships.

Editor's Note

THIS abstract of a most interesting paper is printed because of its importance in representing the point of view probably widely held in the greatest maritime country of the world. It is something to ponder on, even though we cannot agree to the assumption that Great Britain, admitting its peculiar position, should assume dominance in naval and merchant marine power. Our own geographical position and great and growing commerce entitles us to a position of strength on the seas and this we must attain if we are to progress along the lines of our destiny.

WARWICK CASTLE

Twin Screw Motorship

Passenger and Freight

for

South African Service

New Union-Castle South African Liner Warwick Castle—Twin Screw Diesel—Service Speed 15¼ Knots

THAT diesel power in the service from Great Britain to South Africa has worked out in practical operation to the satisfaction of the owner, the Union Castle Mail Steamship Co. Ltd. is evident from the continuation of this type of machinery in vessels for this run. Last fall the motorship WINCHESTER CASTLE began her maiden voyage in the South African mail service from Southampton. At the end of January this year the WARWICK CASTLE, practically a sister ship, though 20 feet longer, sailed on her maiden voyage in the same service. This new twin screw motorship is a sister ship of the CARNARVON CASTLE, which like her, was built and powered by Harland & Wolff Ltd., Belfast. The CARNARVON CASTLE was delivered in 1926. Only one conclusion can be drawn from the fact that the same type of power has been used in these two latest ships, that is, it has been found not only economical, but practical in every other way.

The WARWICK CASTLE is a twin screw motorship and her principal dimensions are: Length between perpendiculars, 650 feet; breadth molded, 75 feet; depth molded, 44 feet 6 inches; gross tonnage, 20,445; service speed, 15¼ knots. Fine accommodations are provided for 760 first, second and third class pasengers generally in single and two-berth rooms. The scheme of decoration in passenger spaces on the WARWICK CASTLE is different from that followed on the WINCHESTER CASTLE.

The British traveler is discriminating and no effort has been spared to provide public rooms and passenger quarters of utmost comfort, good taste and luxurious appointments. The library, for instance, is furnished in the style of the late seventeenth century with windows on three sides under which are placed writing tables of distinctive design in Chinese lacquer. The grand lounge is really an apartment of fine proportions, 65 feet long, 45 feet wide and 20 feet high with a recessed balcony at the after end and a pillared entrance hall at the forward end from which a sweeping staircase goes to the dining saloon. The walls are of silver and the ceiling is supported by 12 octagonal columns of gray maple wood inlaid with ebony. Windows in the lounge extend through two decks. Among the furnishings is included a set of Regency furniture dated 1805. As in the WINCHESTER CASTLE, there is a long gallery which serves as an approach to the smoking room. The smoke room is done in the style of an Elizabethan manor house, with carved oak, red bricks, frescoed walls, tapestry panels and here and there pieces of pewter and brass. Adjoining the smoke room is an American bar and at the after end of the promenade deck is a raised veranda.

A special feature of the passenger accommodations is the grouping of single berth cabins, so that they can be used as suites with private bath. In addition, there are, of course, many self-contained suites of bedrooms, sitting rooms and bathrooms. The second class accommodations and public rooms are also on a high level, equal to anything afloat in a similar category.

In cargo handling facilities the Castle ships have always been well found. On the WARWICK CASTLE numerous cargo booms are served by electric winches giving a maximum speed for handling cargo. The windlass is also electric. Refrigerated cargo space of ample proportions has been provided as well as space for special cargo, mails and specie.

For electric power there are four diesel driven generators, each of 350 kilowatts and one 75-kilowatt emergency generator also diesel driven, placed on an upper deck. The generating sets were supplied by the shipbuilders. All of the deck machinery auxiliaries are electrically operated. Deck auxiliaries include two capstans, one windlass, one warping winch, 16 cargo winches, 16 boat winches and an electrically operated steering gear with Ward-Leonard control.

Watertight doors are electrically operated from the bridge and were designed and manufactured by the shipbuilder. Lifeboats are stowed under gravity davits. There is an electric passenger elevator and an electrically operated pantry hoist. Ventilation is well served by 50 motor driven fans in various parts of the ship. The largest fan is 45 inches in diameter. There is also a complete system of mechanical ventilation served by 17 electrically driven fans. The amount of ventilation is under the control of each individual passenger. Heating is done by electricity using 265 units. Cooking is also done electrically with units distributed throughout the galleys and pantries and include dough mixers, coffee mills, ice cream machines, refrigerating apparatus, hot plates, water boilers and a large baker's oven. The galley ranges are oil fired. Laundry machinery is electrically operated. Other electrically operated machines include one for printing and an echo sounding device.

The main propelling machinery of the WARWICK CASTLE consists of two eight-cylinder 4-stroke cycle double acting, air injection, heavy oil engines of the Harland-Burmeister & Wain type. They are of the same general design and same cylinder dimensions as the machinery which the same company installed in the BRITTANIC with the exception that in the latter vessel there are ten working cylinders. The engines in the WARWICK CASTLE are each provided with two 3-stage compressors driven by cranks off the forward end of the main crankshaft. At 98 revolutions per minute the normal output of the machinery is 13,800 shaft horsepower. The maximum power is

(*Continued on Page* 56)

Transportation on Inland Waterways

Development of Modern River Boats from Early Types—Lines and Equipment Operating — Various Services Described — Discussion of Freight Savings

Part II

BY E. C. POWERS

MODERN types of economical and efficient river towboats have been developed through years of experience with conditions peculiar to river operation. A gradual but definite improvement is noted in design and construction of the vessels themselves, and in addition a marked advance recently in propulsion machinery. As we look at a river towboat of today, capable of moving large tows of barges each with a capacity of 1000 or more tons, it is difficult to realize that these modern boats grew out of the uncertainties and inefficiencies of the craft which were used in the early days of river transportation. The canoe, the pirogue, the flatboat and the keelboat—these were some of the original types from which the modern towboat has been developed.

There is one element in river operation that has no counterpart in water transportation elsewhere. This is the fact that it is possible to float a flatboat or barge down a river with the current, the latter supplying the only means of propulsion. Realization of this in the early history of the rivers produced a wide range of types including the ark, flatboat, and broadhorn, which it was a comparatively simple matter, through the use of sweeps or oars, to float down with the current. The necessity of getting the craft back upstream gave rise to all sorts of means of propulsion. In the case of the flatboat which was broken up after completing its journey downstream and sold for lumber, there was no need of the return upstream. For those craft which the owners deemed valuable enough to warrant moving them back upstream, the means of propulsion might have been oars, poles, towlines or even sails. In some instances, the barge was towed by animals. Branches of overhanging trees were also made use of, the method being referred to as "bushwacking"—moving the barge along by pulling on the tree branches.

The keel boat which appeared in 1808, was usually about 50 feet in length, pointed at bow and stern and having a means of propulsion peculiar to itself. Through the use of push poles on running planks along the side of the hull, the boatmen would, by exerting pressure on the river bottom and walking from bow to stern, move the craft slowly and strenuously along, repeating the operation over and over again. By this method, these boats moved on an average of 20 miles per day. Between 300 and 400 keelboats were in use on the Ohio river in 1811. Sails were tried on the river craft but with no success, due to tortuous channels.

The application of steam to river boat propulsion began in 1811 with the construction of the steamboat NEW ORLEANS, 116 feet in length and 20 feet breadth. Steamboats entered service in rapidly increasing numbers and by 1842, there were 450 steamers in operation on the Ohio and Mississippi. Even though other types of propulsion have appeared, steam is still the power most generally used. Today, practically every type of propelling equipment is in use on the rivers including diesel twin screw direct drive, diesel electric sternwheel drive, steam turbine electric drive and for fuel, pulverized coal and oil.

The use of steel in the construction of river boats began in the year 1881 with the building of the sternwheel steamer CHATTAHOOCHEE, but was not employed to any great extent until 1915. During the war, there was little activity in river boat building, but with the declaration of peace there was a revival in river vessel construction which has continued to the present time.

During the years 1918-1919, due to this great revival of interest in inland waterways as natural avenues of commerce, a study was made by the government of the types best adapted for river service. Attention was given to building materials, economical sizes, lines and propelling arrangements. In October, 1919, 13 vessels were under construction for service on the Mississippi, Warrior, Tombigbee, Alabama, and Black Warrior rivers.

The type of towboat designed for use on the Mississippi was 200 feet long, 40 feet molded beam, 10 feet molded depth, and 6 feet draft. The craft was an all-steel deck vessel with a continuous deck house about 150 feet long, upper deck house about 30 feet long and pilot house about 20 feet long. Power for propulsion of these vessels was provided by two triple expansion inverted type upright engines with cylinders 15½ x 25 x 44 inches by 26-inch stroke. Each of the engines developed 900 indicated horsepower. Steam for these engines was supplied by two watertube boilers, oil fired, having a total of about 8000 square feet heating surface. These vessels are electrically lighted throughout and are equipped with a wireless set with a radius of 600 miles. Electric current for wireless and lighting purposes is provided by two generating sets of 5 and 10 kilowatts respectively. The type of barge used in conjunction with these boats was 230 feet long, 45 feet molded beam and 11 feet molded depth. These barges were constructed throughout of steel. The cargo box was 184 feet long by 37 feet wide.

The type of tunnel stern towboat designed for use on the Warrior river was 140 feet long, 24 feet beam, 8 feet 9 inches molded depth, and 6 feet draft at full load. The vessels were single deck type fitted with a continuous deckhouse 112 feet long. This type of vessel was powered with two triple expansion inverted type upright engines with cylinders 10¾ x 17 x 27 inches and stroke of 18 inches. Each engine developed 400 horsepower at 200 revolutions per minute. Steam was

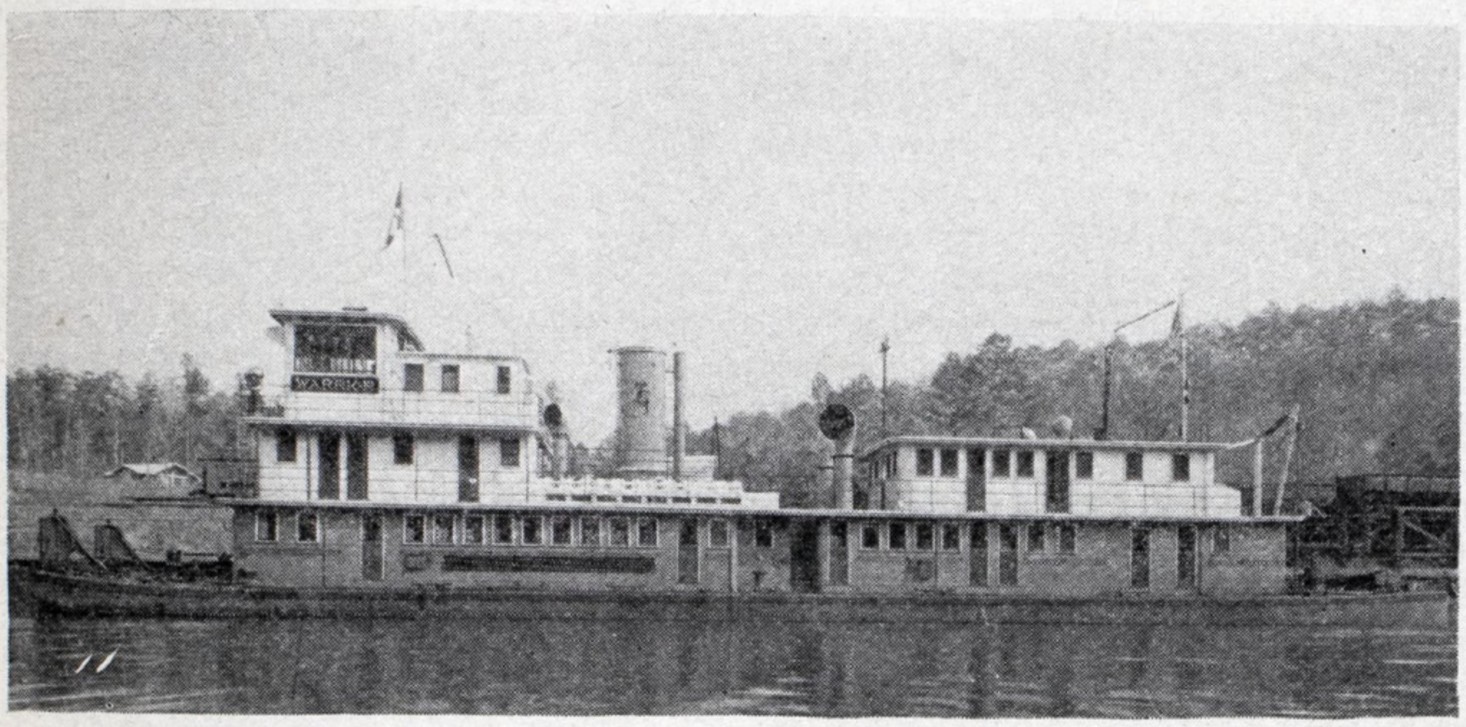
WITH a total valuation of over $150,000,000, the floating equipment operating on the inland waterways of the country represents a means of transportation which annually saves millions of dollars in freight shipping costs. The accompanying article on the lines and boats conducting services on the various important waterways, is the second part of a comprehensive article covering the business of transportation by inland waterways. The third part which is to appear in the June number will cover river terminals and cargo handling facilities. The first part which appeared in the April issue dealt with improvement of 15 of the most important waterways.

Four Modern Types of Power Installed in River Towboats

Diesel Direct Twin Screw

Name .....William Dickinson
Type (towboat or packet) .....Towboat
Owner .....Marquette Cement Co.
Builder .....Marietta Mfg. Co.
Completed .....Oct., 1930
Length overall feet 125
Beam, molded, feet 26
Depth molded, feet 7
Steel or wood .....Steel
Drive .....Twin screw, tunnel stern
Engines....Two 6-cylinder solid injection diesel
Fuel .....Oil
Horsepower at 225 r.p.m. each engine.....350
Where operated .....
.....On Mississippi and Missouri rivers
Remarks .....
Half tunnels in which propellers operate are hexagonal in shape for offering more resistance to rotary motion of water, the belief being that an increase in thrust is obtained.

Towboat William Dickinson owned by Marquette Cement Co.



Towboat Warrior owned by Tennessee Coal, Iron & R. R. Co.

Diesel Electric Twin Screw

Name .....Warrior
Type (towboat or packet) .....Towboat
Owner.....Tennessee Coal, Iron & R. R. Co.
Builders .....
American Bridge Co. & Carnegie Steel Co.
Completed .....Jan. 21, 1929
Length overall, feet inches 140 8
Beam, molded 25
Depth molded 9 3
Steel or wood .....Steel
Drive .....twin screw, tunnel stern
Engines (2).....Six cylinder solid injection diesel. Each driving a 335-kilowatt, 250-volt direct current generator, supplying current to two electric propulsion motors
Fuel .....Oil
Horsepower, each propulsion motor....400 s.h.p.
Where operated .....Warrior River
Capacity in barges .....seven
Remarks .....
Diesel electric propelling equipment has also been used in various towboats in connection with stern wheel drive.

Universal Unaflow Steam

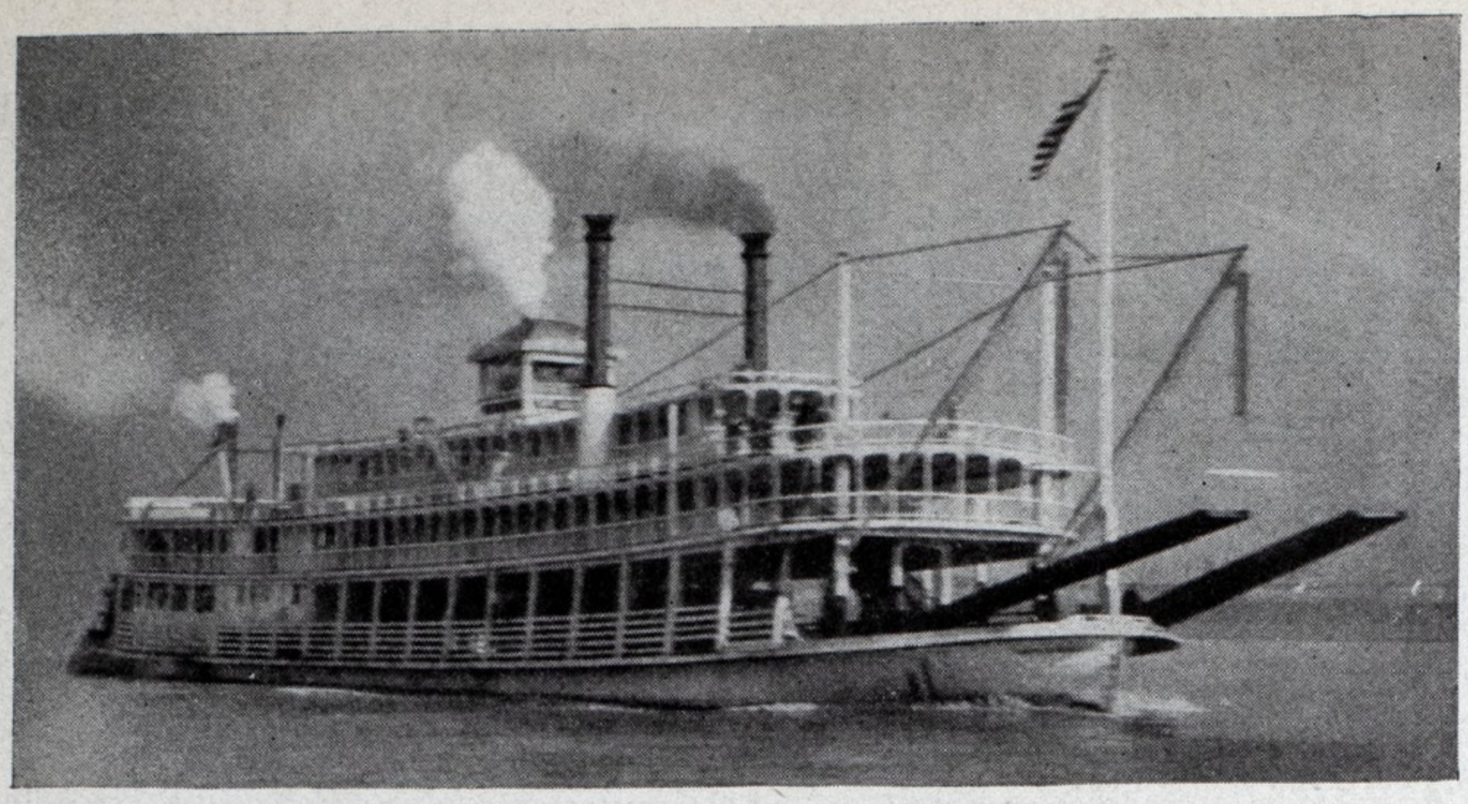
Name .....Ohio
Type (towboat or packet) .....Towboat
Owner.....Mississippi Valley Barge Line
Builder .....The Dravo Contracting Co.
Completed .....Sept. 19, 1930
Length, feet 200
Beam, feet 40
Depth, feet, inches 10 6
Steel or wood .....Steel
Drive .....tunnel stern twin screw
Engine.....(2) Unaflow universal condensing
Fuel .....Oil
Horsepower, both engines.....2000
Where operated——Ohio and Mississippi rivers
Cargo capacity, in barges 20-30
Remarks .....
The Ohio is one of four sister ships recently placed in operation by the company. The Tennessee is powered with Unaflow engines, the Indiana and Louisiana with turbine electric. Began operations late 1930.

Towboat Ohio owned by Mississippi Valley Barge Line

Towboat Dwight F. Davis owned by Inland Waterways Corp.

Pulverized Coal Burning

Name .....Dwight F. Davis
Type (towboat or packet).....Towboat
Owner .....Inland Waterways Corp.
Builder .....Charles Ward Engineering Works
Completed .....April 25, 1929
Length, feet 140
Beam, feet 25
Depth, feet 9
Steel or wood .....steel
Drive .....Twin screw, tunnel stern
Engine....Triple expansion reciprocating steam
Fuel .....Pulverized coal or oil
Horsepower 1000
Where operated .....Mississippi river
Net tonnage 156
Remarks .....
This boat is the first vessel built for river service using pulverized coal as fuel. It is the result of a progressive attempt on the part of the owners to develop greater economy.



Modern type of passenger and packet freight steamer in operation on the Mississippi and Ohio rivers

supplied by two boilers arranged to burn coal.

The type of craft designed for use on the Tombigbee, Alabama and Black Warrior rivers was a twin screw tunnel stern self-propelled steel barge. This craft was 280 feet long, 49 feet molded beam, 10 feet molded depth with a maximum draft of 7 feet. Cargo was carried on the main deck. An open cargo box located forward of amidships accommodated 1600 tons of coal. At each end of the coal space, enclosures were provided for package freight. Power for these vessels was provided by two inverted upright triple expansion steam engines with cylinders 10¾ x 17 x 27 inches with 18-inch stroke. These engines each developed 400 horsepower at a shaft speed of 200 revolutions per minute. The boilers were two in number and of the marine watertube type, each having approximately 1400 square feet of heating surface.

The development of barge navigation on the Ohio river began about the year 1850. The towing of barges laden with coal from the Monongahela river down the Ohio river and thence over the Mississippi to New Orleans was done in large tows of wooden barges. These tows frequently carried as high as 25,000 tons of coal below Louisville, at which point the tows were often regrouped to double the size hauled on the upper reaches of the Ohio. In 1887, there were four lines operating 16 propelling units and 120 barges between St. Louis and New Orleans, in which service grain constituted the principal commerce. These barges had capacities up to 60,000 bushels of grain each. The size of the tow in the grain trade averaged from four to six barges.

In the coal trade in the year 1902 60,000 tons were sometimes carried in one tow from Louisville to New Orleans. These loads were hauled in barges propelled by one of the largest wooden towboats in the history of river transportation. This vessel was the SPRAGUE built in 1902, 276 feet long, 61 feet breadth, 6 feet deep, of the stern wheel type and fitted with compound steam engines of 1600 horsepower.

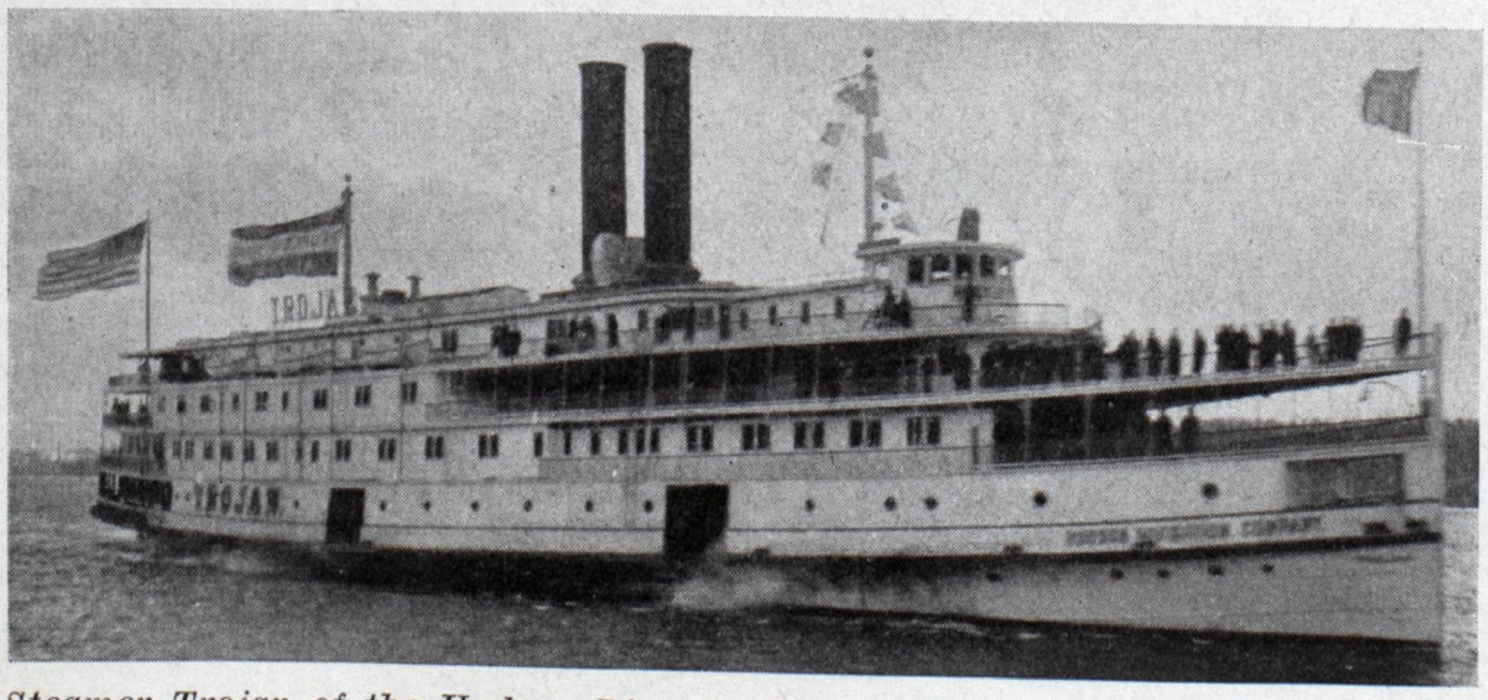
The use of steel in the construction of barges did not commence until 1900 and did not become general practice until about 1915. During the war, there was not much activity in barge building, but since that time, considerable progress has been made in the design and construction of barges. In fact, barges are now most generally built of steel and their capacity in the coal, gravel and steel trades varies between 800 and 1000 tons. More than 65 per cent of the barges in use on the Ohio river are steel having a capacity of over 500 tons. Only a very small percentage are of less than 500 tons capacity. Barges used to haul coal, unfinished steel, gravel, stone and sand are of the open type. For hauling manufactured steel, cement, and miscellaneous freight which requires protection, covered barges are operated. There are also specially constructed tank barges for hauling oil and gasoline. The time required for the journey upstream from New Orleans to Pittsburgh in the case of the packet freight boats hauling miscellaneous packet freight, is about 22 days, downstream about 14 days. In the case of large tows of coal, coke and steel products, the time upstream between the two points is about 27 days; downstream, 20 days. Considerable time is required for breaking up tows at locks.

The large number of small towboats powered with internal combustion engines in operation on the inland waterways of the country bear witness to the many transportation operations which are carried on by the boat lines. By referring to Table I on Page 25, and Table III on Page 28, which list the equipment of lines operating three or more boats on the inland waterways of the country, some idea can be gained of the extent to which internal combustion engines are used for power.

Today, there are approximately 485 boat lines operating about 1300 propelling units and 4500 barges on the inland waterways of the country. Value of this equipment is estimated as more than $150,000,000.

Approximately 300 concerns operate one or more boats on the Mississippi-Ohio system, which is made up of the Mississippi, Ohio, Monongahela, Missouri, Allegheny, Illinois, Tennessee, Cumberland, and other tributary streams. About 36 of the lines own and operate three or more boats and run on more or less regular schedules. Of these 36 lines, particulars of which are given in Table I on Page 25, eleven are purely common carriers, three contract, two both contract and common, 17 private and three both contract and private. These carriers, which operate under contract or for private enterprises, represent a great diversity of interests, including steel corporations, coal companies, sand and gravel concerns, lumber interests, etc.

The great bulk of the commerce over this waterway is borne in the boats and barges of the large corporations. Steel and coal make up the greatest portion of the river traffic, although the traffic in grain and farm products is of great importance. In the matter of finished products and miscellaneous packet freight, the common carrier lines render a great service to all the people of the nation, by carrying freight at low cost, there-



Steamer Trojan of the Hudson River Navigation Corp. operating between New York City and Albany on the Hudson river

Table I--Particulars of Service and Equipment of Inland Waterway Lines in the United States

Boat Lines and Equipment Operating on Mississippi-Ohio System

(Only Lines Operating Three Boats and Over Are Included)

NAME OF LINE OR COMPANY	NO. BOATS	*TYPE	TOTAL GROSS TONS	TOTAL I. H. P.	NO. BARGES	CARGO CARRIED
American Barge Line, Inc.	7	4 st. 3 i.c.	1529	3658	48	Iron, steel, crude oil, misc.
Barrett Line, Inc.	3	st.	829	1465	34	Steel, stone, lumber
Baton Rouge Coal & Towing Co.	4	2 st. 2 i.c.	108	366	6	Coal, wood, machinery
Carnegie Steel Co.	17	13 st. 4 i.c.	5035	11,760	357	Coal, coke, steel products
Crucible Fuel Co.	3	st.	593	1200	102	Coal
Cumberland Transportation Co.	3	st.	525	1865	7	Passengers and freight
Davison, J. K. & Bro.	5	4 st. 1 i.c.	999	1481	140	Sand and gravel
Eagle Packet Co.	6	st.	1423	2578	3	Passengers and freight
Higgins Lumber & Export Co.	5			358		Lumber, logs
Hillman Transportation Co.	3	st.	616	1600	60	Coal and iron
Hull Packet Line	3	i.c.	27	85	2	Passengers and freight
Inland Waterways Corp.	Data given in Table II on Page 26					Miscellaneous freight
Jones & Laughlin Steel Corp.	8	st.	1498	3900	113	Coal, steel, wire, pipe
Kansas City Bridge Co.	16	2 st. 14 i.c.			60	Stone, piling, etc.
Keystone Sand & Supply Co.	6	3 st. 3 i.c.	754	1480	68	Sand and gravel
Kosmos Portland Cement Co.	5	i.c.	349	990	19	Limestone, cement, oil
La Belle Transportation Co.	4	3 st. 1 i.c.	1149	1889	86	Coal, steel products
Louisville & Cincinnati Packet Co.	4	st.	2358	3019		Passengers and freight
McCrady Rodgers Co.	5	4 st. 1 i.c.			72	Sand and gravel
Mississippi Valley Barge Line	4	st.	3654	8000	50	Miscellaneous freight
Missouri Portland Cement Co.	4	st.	1269	560	21	Sand and gravel
Ohio & Mississippi Transit Co.	6	4 st. 2 i.c.	669	1295	100	Coal, rock asphalt
Ohio River Sand & Gravel Co.	6	5 st. 1 i.c.	227	650	47	Sand and gravel
Pittsburgh Coal Co.	4	st.	738	1922	70	Coal
Portsmouth Sand & Gravel Co.	3	i.c.	77	72	16	Sand and gravel
River Log Co.	3	i.c.			4	Lumber
Shawneetown & Rosiclare Packet Line	3	i.c.	267	174	1	Passengers and freight
Standard Oil Co. of Louisiana	13	9 st. 4 i.c.	4997	10,460	41	Petroleum, gasoline
Standard Unit Navigation Co.	3	i.c.			8	Flour, feed, groceries, etc.
St. Louis & Tenn. River Packet Co.	3	2 st. 1 i.c.	645	980	2	Passengers and freight
Streckfus Steamers	4	st.	2925	3283		Passengers and freight
Tennessee Coal, Iron & R. R. Co.	3	i.c.	836	2000	39	Steel products, ore, sulphur
Union Barge Line	5	st.	1521	2649	28	Miscellaneous freight
Venable, Walter	3	i.c.	107	220	7	Miscellaneous freight
Vesta Coal Co.	6	5 st. 1 i.c.	1662	3250		Coal
West Kentucky Coal Co.	6	st.	1544	2880	154	Coal
West Virginia Sand & Gravel Co.	4	1 st. 3 i.c.	157	315	18	Sand, gravel, cement

*St.: Steam propulsion. i.c.: internal combustion.

Boat Lines and Equipment Operating on Hudson River and New York State Canal

Cornell Steamboat Co.	44	st.	4265	13,346		Towing service only
Cowles Towing Co.	8	st.	447	824	4	Miscellaneous freight
Erie & St. Lawrence Corp.	*5	i.c.	5200	**2020		Grain, sugar, miscellaneous
Hedger Transportation Co.	9	st.	1363	3115	60	Sulphur, grain, pig iron
Hudson River Day Line	7	st.	15,069	24,560		Passengers and freight
Hudson River Navigation Corp.	8	st.	18,860	19,400		Freight and passengers
Marine Transit Corp.	8	1 st. 7 i.c.	390	1820		Metals, ores, grain products
Standard Transportation Co.	37	26 st. 11 i.c.	15,426	20,694	163	Petroleum products

*Self-propelled barges.
**Brake horsepower.

Boat Lines and Equipment Operating on Columbia and Willamette Rivers

Arrow Tug & Barge Co.	4	i.c.	94	380	3	Passengers, lumber, machinery
Crown Willamette Paper Co.	10	i.c.		307	4	Sulphur and wood
Harkins Transportation Co.	*6	5 st. 1 i.c.	2761	2625		Passengers, misc. freight
Hosford Transportation Co.	4	2 st. 2 i.c.	780	1610	9	Logs, lumber, etc.
Lincoln County Tug & Barge Co.	5	i.c.	193	710	2	Logs and supplies
Shaver Transportation Co.	10	5 st. 5 i.c.	2615	4430		Logs
Smith Transportation Co.	7	4 st. 3 i.c.	696	1505		Logs
Western Transportation Co.	9	7 st. 2 i.c.	3802	3610	16	Paper, mill supplies, etc.
Willamette & Columbia River Towing Co.	6	4 st. 2 i.c.	1704	3020		Logs

*One vessel under construction.

Boat Lines and Equipment Operating on Sacramento and San Joaquin Rivers

Booth, F. E. & Co.	7	i.c.	270	590		Fish, fruit, vegetables
California Transportation Co.	11	st.	7010	8027	1	Passengers and freight
Colberg Motor Boats	6	i.c.	84	320		Passengers and freight
Erikson Navigation Co.	3	i.c.	38	245	5	Sugar, beets, lumber, grain
Fay, N. & Son	3	i.c.	331	410		Farm products
Harbor Tug & Barge Co.	38	3 st. 35 i.c.	958	4990 s.h.p.	48	Passengers, oil, rock, sugar
Hunt Hatch Transportation Co.	3	i.c.	531	750		Canned goods and produce
Island Transportation Co.	4	i.c.	71	430	11	Grain, mill feed, etc.
Larkin Transportation Co.	4	1 st. 3 i.c.	451	295		Fruit, produce, canned goods
Nickols Transportation Co.	3	i.c.	353	290		Vegetables
Rideout, E. V. & Co.	3	i.c.	77	555	5	Flour, oil, asphalt
Sacramento Navigation Co.	11	9 st. 2 i.c.	3525	2083	23	Flour, oil, grain, rice
Standard Oil Co. of Calif.	*11	1 st. 4 i.c.	**235	**1095	***8	Gasoline, oil, petroleum
Wallenrod, George Co.	3	i.c.	58	325	5	Lumber, oil, steel, rock

*Includes six self-propelled tanks.
**Exclusive of self-propelled tanks.
***Tanks.

Particulars of Lines Operating on Atlantic Coast, Gulf and Florida Waterways Are Given in Table III, Page 28.

by reducing prices for products moving in and out the vast territory drained by this gigantic river system.

The Inland Waterways Corp., owned by the United States, and governed by the secretary of war, operates what is now known as the Federal Barge lines, formerly known as the Mississippi-Warrior Service. This corporation is the largest common carrier line operating on an inland waterway.

Operations of the Mississippi-Warrior service were first begun Sept. 5, 1918 with the commandeering of all privately owned floating equipment on the New York State Barge canal, the Mississippi and Warrior rivers, to relieve the extreme freight congestion existing at that time due to the state of war. The activities of the division of inland waterways was transferred Mar. 1, 1920 to the secretary of war who created a separate branch of the war department known as the Inland and Coastwise Waterways service to carry on the operations of the service. The inefficient and poorly organized Inland and Coastwise Waterways service, operating as a national defense project, was succeeded in 1924 by the present business organization known as the Inland Waterways Corp. At present, there are three divisions of the service, the lower Mississippi division, operating between New Orleans and St. Louis, the Upper Mississippi division operating between St. Louis and Minneapolis and the Warrior division operating between New Orleans and Mobile across Mississippi sound and between Mobile and Birmingport, Ala. Operations by the Inland Waterways Corp. were recently authorized on the Illinois and Missouri rivers.

Floating equipment acquired at the beginning of service in 1918 consisted of a miscellaneous collection of vessels, the greater part of which were aged, built of wood in poor condition and in every way unsuitable for modern transportation. Practically all of the equipment acquired during the emergency has been abandoned, sunk, or otherwise disposed of.

With few minor exceptions, all of the floating equipment now in service has been designed and constructed for modern use. The barges and towboats are constructed wholly of steel. The barges are standardized and capable of carrying 2000 tons on a 9-foot channel and 1000 tons on a 6-foot channel. Certain types of towboats have been designed for use on a 9-foot channel and certain other types for use on a 6-foot channel. The floating equipment of the Inland Waterways Corp. is given in Table II on this page.

Table II--Floating Equipment of Inland Waterways Corp.

Operating Between New Orleans and St. Louis

TYPE	NUMBER	LENGTH	BEAM	DEPTH	FUEL	H. P.	CAPAC. TONS
Twin screw tunnel	7	200	40	10	Oil	1800	.....
Stern wheel	2	262-2	58	8	Oil	2000	.....
Stern wheel	1	262-6	58	8	Coal(pulv)	2000	.....
*Twin screw tunnel	1				Oil(diesel)	2200	
Barge (twin screw)	3	280	49	10	Oil	800	1600
Barge (covered)	90	230	45	11			2000
Barge (open)	19	300	48	10			3000

*Most powerful towboat ever built for use on any inland waterway in the world.

Operating Between St. Louis and Minneapolis

Stern wheel	4	159	4½	35	5	Oil	600	.....
Stern wheel	2	196		42	6	Oil	1000	.....
Barge (covered)	60	126		33	7 6			500

Operating Between New Orleans and Birmingport, Ala.

Twin screw tunnel	3	140		24	8 9	Oil	800	.....
Twin screw tunnel	1	140		25	9	Coal(pulv)	1000	.....
Barge (self-propel)	1	280		49	10	Oil	800	1600
Barge	52	140		25	4 6			500

Under Construction for Use on Illinois and Missouri Rivers

Stern wheel	3	196		42	6	Oil	1000	.....
Barge (open)	20	300		48	10			3000
Barge (covered)	30	230		45	11			2000
Barge (track)								30 cars

The principal commodities carried by vessels of the corporation are: Grain products, tobacco, cotton, sugar, sisal, salt, sulphur, bags, canned goods, miscellaneous merchandise, automobiles, beverages, ore, agricultural implements, coal, etc. The average tow is capable of moving 12,000 tons. Tonnage transported during 1919, the first full year of operation was approximately 235,000 tons. In 1929 the figure was 1,653,381 tons. Approximately 69 per cent of the 1929 tonnage was interline, that is, water-rail, or rail-water-rail, showing that communities in the interior, not located on the banks of the Mississippi and Warrior rivers, are taking advantage of cheaper transportation offered by water shipment.

The report of the Inland Waterways Corp. for the year 1930 shows a net profit of $65,177.09 compared with a loss in 1929 of $72,798.08.

The American Barge line is the largest of the privately owned common carrier boat lines operating on the Mississippi and Ohio rivers. This line operates seven towboats, three of which are motor and four steam driven, and 48 steel barges. The total gross tonnage of the towboat fleet is 1529 and total indicated horsepower 3658. Of the barges, ten are of the open steel type, 23 steel covered and 15 steel tanks. This line maintains a schedule of between three and five trips downstream per month, and three trips upstream carrying freight between Pittsburgh and New Orleans. Freight carried consists of iron and steel products, crude oil, gasoline, sugar, cement, wire products, etc. Unfinished iron and steel products, sand, stone, gravel, etc., which do not require protection from the weather are carried in open steel barges. Other products which must be protected from the weather are carried in covered steel barges. Oil, gasoline, etc. are hauled in modern steel tanks.

The Carnegie Steel Co., Pittsburgh, is the largest of the private carriers operating on the Mississippi-Ohio system. This line began operation in 1917 with the towboat DUQUESNE which has since been sold. The company tows coal from various mines on the Monongahela river and coke from furnaces on the Allegheny and Ohio rivers. Other materials incident to steel mill operation are also carried between the various plants which have wharves. Finished steel products are towed from Munhall, Pa., to various cities along the Ohio and Mississippi rivers as far south as New Orleans. On the return trip upstream, sulphur usually makes up the cargo.

The company operates 15 steam towboats of the stern wheel type and approximately 356 steel barges, 328 of which are open steel type, 28 covered steel and one steel tank. In addition, four small gasoline motor driven tugboats are used for shifting barges at landings. All of the towboats now in service are of steel hull construction.

Nearly all of the barges are 175 feet long by 26 feet wide by 11 feet deep, capable of carrying 850 net tons of cargo on a draft of eight feet. For towing coal, coke, and other products not affected by the weather, open type barges are used. Finished products, which must be protected from the weather, are carried in covered barges. A hatch which can be opened extends practically the full length of the hopper. Each barge has five loading doors on one side. Boats in the coal and coke trade have a speed of 5.5 to 9 miles per hour. Boats operating in the down-river trade have a speed of 4.35 to 6.88 miles per hour. The company maintains a marine ways with

five berths for the care and repair of its boats and barges.

In the coal and coke trade, six barges of 850 net tons each, are towed, later returning empty. In the down-river trade, 15 barges of 850 net tons are towed downstream and usually six barges, each loaded with 500 tons of sulphur are towed upstream, the remainder of the barges returning empty.

The most recent interest to enter the inland waterways transportation business on the Ohio and Mississippi river between Cincinnati and New Orleans is the Mississippi Valley Barge line which was authorized by the Interstate commerce commission July 24, 1930 to operate a fleet of barges on the above rivers. This company, which is a $3,000,000 concern, proposes to establish through barge-rail and rail-barge-rail routes by way of Cincinnati for points ordinarily served only by all-rail routes.

Four new towboats of a distinctly advanced design, the OHIO, TENNESSEE, INDIANA, and LOUISIANA were recently built for this company. These vessels are all steel, tunnel stern, twin screw type and are identical in hull particulars and general layout. The principal dimensions are: Length molded 200 feet, beam molded 40 feet, depth molded 10 feet 6 inches. The OHIO and TENNESSEE are both powered with two 3-cylinder vertical unaflow condensing engines with a total horsepower in both engines of 2000. The INDIANA, and LOUISIANA are fitted with turbine electric drive. Steam is supplied by two oil-fired watertube boilers. These boats are illustrated and described in the April issue of MARINE REVIEW.

The barges which are operated in conjunction with these towboats are of new design. They have an overall length of 109 feet, width of 21 feet but with fairly high deckhouse. Each barge has a hold volume of 9300 cubic feet and an additional 9700 cubic feet in the deckhouse. The barge ends are wedge shaped for close grouping of a large number in one tow. On fast runs ten barges are towed, but where speed is not the main consideration, from 20 to 30 barges can be towed. Fifty barges of this type have been built for the company.

The Mississippi Valley Barge line began operation of a weekly service between Cincinnati and New Orleans in the fall of 1930.

Eight lines owning and operating three or more boats maintain services on the Hudson river or New York State barge canal or both. All but two of these lines operate under contract only. The two other common carrier lines do not operate through the canal. The Cornell Steamboat Co., the largest of the carriers operating on these waterways, runs on contract on both the canal and river. The Standard Transportation Co., another contract carrier, also operates on both. The Hedger Transportation Co., Inc., operates on both in contract service. Of the other five lines, the Cowles Towing Co., the Erie and St. Lawrence Corp., and the Marine Transit Corp. operate on the canal only; the other two lines, the Hudson River Navigation Corp. and the Hudson River Day Line run only on the river.

Two log towing boats used by the Western Transportation Co. for towing logs on the Columbia river

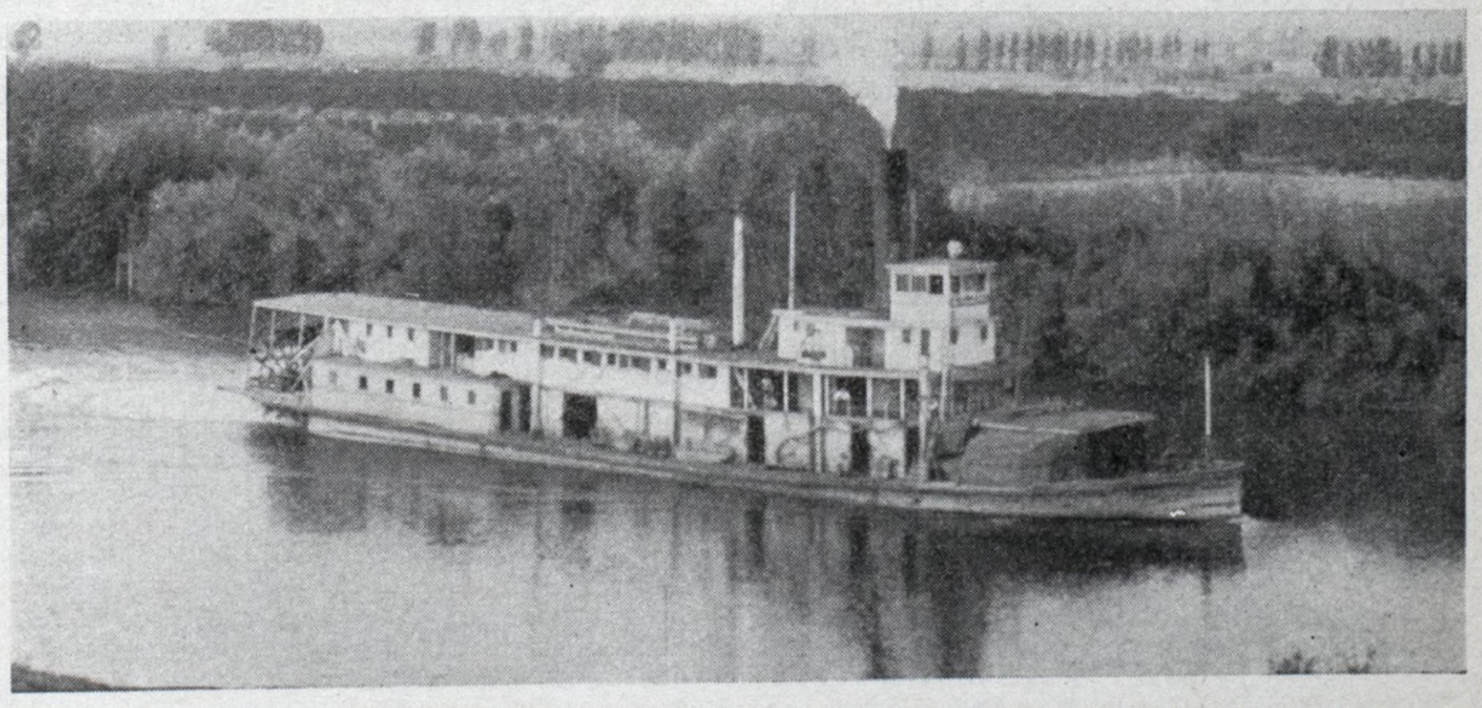
The Hudson River Navigation Corp. operates a freight and passenger service on the Hudson river between New York, Albany and Troy, a distance of approximately 160 miles. The line operates from about the middle of March until Dec. 1. During the winter season, freight is shipped to Poughkeepsie, and there transferred by motor truck the remainder of the distance.

The vessels of the company are operated by night, the leaving hour at the southern terminal being 6 p. m. and the northern terminal, 9 p. m. The hour of arrival at either end of the line is between 6 a. m. and 7 a. m. The type of cargo carried consists mainly of package freight and the automobiles of summer tourists. Freight tonnage averages approximately 175,000 tons annually. The number of passengers carried averages about 200,000 per year, and the number of automobiles carried is about 20,000 annually.

The floating equipment of the Hudson River Navigation Corp. consists of four large steel passenger and freight vessels, the BERKSHIRE, the FORT ORANGE, the RENSSELAER, and the TROJAN; also two smaller freight and automobile carriers, the GREEN ISLAND and the COHOES, built of wood. The company also operates the Hudson River Steamboat Co. between New York, West Point, Newburgh, Poughkeepsie and other central Hudson river points. Two steamers are operated in this service, the steel hull vessels POUGHKEEPSIE and the BENJAMIN B. ODELL. The average annual freight moved by these vessels is approximately 85,000 tons.

Particulars of seven other lines conducting services on the Hudson river or New York State Barge canal or both are given in Table I on Page 25.

The type of boats operating on the rivers and waterways of the Atlantic coast, Gulf and Florida is determined by the channel dimensions of the waterways upon which they are operated. These range from small motor boats of 30 feet and less in length to large steamboats 300 feet in length.



One of the steamers of the Sacramento Navigation Co. which operates between San Francisco and Sacramento on the Sacramento river

Table III--Particulars of Service and Equipment of Inland Waterway Lines in the United States

Boat Lines and Equipment Operating on Atlantic Coast, Gulf and Florida Waterways

NAME OF LINE OR COMPANY	WHERE OPERATES	NO. BOATS	TOTAL GROSS TONS	TOTAL I. H. P.	BARGES	CARGO CARRIED
Baltimore & Philadelphia Steamboat Co.	Delaware river and Chesapeake bay	4	3023	3420	1	Passengers and freight
Baltimore & Virginia Steamboat Co.	Potomac and Rappahannoc rivers	12	10,160	9750	4	Passengers and freight
Beardslee Launch & Barge Service	Mobile and Tombigbee rivers	5	100	279	14	Misc. freight
Buxton Line	James and Appomattox rivers	4	851	279	3	Passengers and freight
Card Lumber Co.	Alabama rivers	3		112		Freight, logs
Chesapeake & Delaware Steamboat Co.	Chesapeake bay tributaries	3	1174	1225	1	Groceries, vegetables
Chesapeake Steamship Co.	Chesapeake bay tributaries	5	10,199	11,650	2	Passengers and freight
Coppedge, J. H. & Co.	St. Johns river	4			19	Fuel oil, lime, rock
Donaldson, William J.	Delaware river	4	408	1615	8	Freight, coal
Florida Railroad & Navigation Co.	Caloosahatchee and Barrons rivers	4	1628	2800	2	Misc. freight
Hartford & N. Y. Transportation Co.	Raritan and Connecticut rivers	10	7217	8465	25	Passengers and freight
Inland Waterways Corp.	Warrior river	See Table II on Page 26.				
Kinzie Bros. Steamer Line	Caloosahatchee river	5	94	263	5	Fruit, shells, grain
Merchants & Miners Transportation Co.	Atlantic Intracoastal waterways	4	244	20	43	Passengers and freight
Norfolk, Baltimore & Carolina Line	Waterways, Va., Md. and N. C.	9	1675	1560		Miscellaneous freight
Norfolk Lighterage Co.	James, Potomac rivers	15	3851	2232	21	Miscellaneous freight
Norfolk & Washington Steamboat Co.	Potomac river and Chesapeake bay	3	6264	7800		Passengers and freight
Sheridan & Co.	Delaware river	4	220	950	13	Miscellaneous freight
Southern Transp. Co.	Atlantic waterways	17	28 862		115	Coal, iron, steel
Stone Towing Line	Atlantic waterways	8	569	1965	1	Lumber, piling, cement
Texas Co.	Atlantic coast rivers	11	2311	3850	*13	Petroleum products
Wilson Line	Delaware river	7	4681	11,700		Passengers and freight
Wood Towing Corp.	Chesapeake tributaries	14	2464	8075		Miscellaneous freight
Zigler, G. B. & Co.	Atlantic waterways	5		332	35	Rice, crude oil, lumber

*Steel Tanks.

Particulars of lines and equipment appear in Table III on this page.

Of the purely common carriers, that is those which do not operate under contract nor for private interests, the Stone Towing line might be taken as a typical example. This line operates on sections of the Atlantic intracoastal waterway between Georgetown, S. C. and Baltimore, Md. A fleet of eight vessels runs on a monthly schedule carrying lumber, piling and cement. These boats vary in length between 40 and 117 feet and in indicated horsepower between 30 and 800. The boats are all towboats, three of them steam, and five diesel. The age of these boats reaches as far back as 1876 and none of them was built later than 1913.

A number of lines running on Chesapeake Bay, the Potomac and Rappahannock rivers, operate vessels which are over 160 feet in length. Of such lines, the Baltimore and Virginia Steamboat Co. operates a fleet of 12 freight and passenger steamers, between Baltimore, Washington, and points in Virginia. This line is a common carrier and runs daily except Sundays, carrying fish, oysters, canned goods, vegetables, tin cans, and general merchandise. The boats operated by this line range in size from 165 feet to 206 feet. Their power runs as high as 1800 indicated horsepower. The larger boats carry a crew of 46 men. The age of these boats is 19 years for the more recent and 48 years for the oldest.

Of the lines operating three or more boats on the rivers and waterways of the Pacific coast, including the Columbia and Willamette rivers, Oregon and Washington and the Sacramento and San Joaquin rivers, California, eight are in operation on the Columbia and Willamette, and 14 on the Sacramento and San Joaquin rivers. Of the eight on the Columbia and Willamette, only three are so-called common carriers, the remainder being two private, and three contract. On the California rivers, by far the greater proportion are common carriers. Of the 14 lines on these rivers, eight are of the common carrier class, two are contract, two common-contract, and two private.

Of the common carriers the Western Transportation Co. operates a daily freight and passenger service from Portland, Oreg., to nearby points on the Columbia and Willamette rivers. The freight carried by this line consists of paper, raw materials, and mill supplies. The fleet of seven vessels consists of two passenger steamers, three freight steamers, and two steam towboats. The length of these vessels ranges from 135 to 157 feet. This line also owns and operates 14 barges, made up as follows: ten open wooden barges, three open steel barges, and one steel tank.

In respect to operating equipment, the Sacramento Navigation Co. is the largest of the common carrier lines operating on the Sacramento or San Joaquin rivers. This line maintains a triweekly schedule of sailings carrying fuel oil, grain, rice and miscellaneous freight between San Francisco and Sacramento on the Sacramento river. This line operates a fleet of 11 boats and 23 barges. The vessels consist of nine steam and two motor vessels, of the barges, 18 are open wood, three covered wood and one wooden tank. The two motor vessels are 36 and 56 feet in length respectively. The other boats vary in length between 141 and 178 feet.

The California Transportation Co. operates on both the Sacramento and San Joaquin rivers. This line runs daily from San Francisco to Sacramento on the Sacramento river and from San Francisco to Stockton on the San Joaquin river. Freight and passengers are carried, the freight consisting almost exclusively of vegetables. The vessels of this line, making a fleet of 11 boats are all steamers ranging from 144 to 250 feet in length. One covered wooden barge is also operated.

Particulars of other lines operating in these trades are given in Table I on page 25. These lines serve as feeders to the intercoastal lines and offer the benefits of low cost freight transportation to territories which they serve. Practically all of the lines have joint freight rates with connecting railroads serving the western states.

(*Continued on Page* 56)

Table IV—Savings in Joint Rail-Water Shipments

Rates on Canned Vegetables per Hundred Pounds in Carload and Less than Carload Lots

Origin From	Destination to	All Rail C.L.	All Rail L.C.L.	Joint Rates C.L.	Joint Rates L.C.L.	Savings in Joint Rates C.L.	Savings in Joint Rates L.C.L.
Fort Wayne, Ind.	New Orleans	0.77	1.22	0.65	1.01	0.12	0.21
Grand Rapids, Mich.	"	0.81	1.29	0.69	1.10	0.12	0.19
Detroit, Mich.	"	0.81	1.31	0.69	1.10	0.12	0.21
Cleveland, O.	"	0.81	1.33	0.69	1.12	0.12	0.21

Note: Rates all-rail via New York Central railroad between points mentioned and New Orleans. Joint Rates via New York Central and Big Four railroads to Cairo, Ill., thence by Inland Waterways Corp. to New Orleans. From this table of rates, it can be seen that in case of carload lot shipments between Fort Wayne, Ind. and New Orleans, the shipper can realize a saving on 10 tons of $24. On less than carload lot shipments, the savings would be higher still, $42 on the same 10 tons. Over a year's time, the amount of the total savings shipping by joint routes can be appreciated.

European Shipping at New Low Point

Passenger Travel Affected—Royal Mail Reorganized—Reduction in Fares—Empress of Britain Nearly Ready—Progress on New Cunarder—Continent Not as Hard Hit

By Frank C. Bowen

THE man connected with European shipping or shipbuilding nowadays has ceased even to talk about the probability that the situation has reached rock bottom, because it cannot conceivably get worse; every quarter seems to bring forward new possibilities of depression. There must be an end to the slump some day, of course, just as there has been an end to every slump that has preceded it, but it is imposible to prophesy when it will come about; all the prophecies of the last eight years have been so regularly contradicted by the facts.

If any European shipping company can prosper, it must be the Cunard company, with its huge connection, magnificent material and high reputation; yet even that concern has been forced to pass its dividend for the first time since 1908, and the figures that were published when the decision was made are startling. The gross profits for 1930 are £2,662,396, as against £3,628,905 for 1929, while the net profit has decreased from £809,639 to £18,601. The preference shareholders have received their full dividend, and the balance remaining to be carried forward is reduced from nearly £400,000 to £278,867.

Every branch of the company's activities has been affected by modern conditions. The first class on the Western ocean is naturally affected by the conditions in the United States. Australia's position has hit the Commonwealth and Dominion branch of the business very hard indeed, and the third class is only a shadow of its former self, particularly to Canada, where emigration is practically nonexistent. Therefore, it is careful finance to pass the dividend, however disappointing it may be to the shareholders, but, on the other hand, the real position of the company is, undoubtedly, extraordinarily strong.

Its old connection with the American-Levant line has been broken, and all its shareholding in that concern has been sold to the managers. On the other hand, it has taken over the smart little fleet of small steamers, with which it will maintain its traditional service to the Mediterranean, and in the meanwhile the American-Levant company has sold the majority of its other ships to Italians.

The troubles of the Kylsant group culminated in a very stormy meeting of the White Star shareholders and Royal Mail Steam Packet Co. debenture holders, at which a moratorium was granted after a number of startling revelations had been made as to the true position and recent actions of the group. Matters are not by any means settled yet, and the committee which is trying to put things on a sound basis, under the guidance of Walter Runciman, is acknowledged to have its hands very full and to be faced with an appallingly difficult task. It will probably be some considerable time before its investigations are complete, and what will then happen can scarcely be predicted. Owing to doubts as to the limited liability of the Royal Mail Steam Packet Co.'s shareholders, its stock was for a short time selling at 10s per £100 face value, but it has since recovered from that price.

Many other companies have had to pass their dividends, particularly those which are keenly interested in the grain business, which has slumped so badly. After the first year's working under the pooling agreement between the Hamburg American and the North German Lloyd lines, both companies have decided to pay 6 per cent, as against 7 per cent and 8 per cent respectively last year. This, however, has only been made possible by the large sums received from the United States government in compensation for tonnage seized during the war. In the case of both companies the profit is very considerably down, but they agree that it would be worse still were it not for the pooling agreement. European companies, by the way, have still to see the result of the similar pooling agreement made between the Nippon Yusen Kaisha and the Osaka Shosen Kaisha.

Most of the Atlantic companies have to reduce their fares materially and to make great concessions in the matter of return facilities in order to attract any passengers at all. In the marked degree to which the second class is falling into disfavor continues, even the Cunard MAURETANIA having all her old second-class accommodation converted to tourist third, leaving the old second-class patronage to the cabin ships, which get by far the greater part of it anyhow.

In such circumstances it is not surprising that very few first-class ships are being ordered or laid down, although one or two very interesting ones are in course of construction. At the time of writing, the new Canadian Pacific EMPRESS OF BRITAIN is practically complete, and her advent on the St. Lawrence trade will make a huge difference. It is realizing one of Canada's oldest and fondest dreams, but it cannot be pretended that the underwriter is particularly pleased with the idea of such a size and speed on the St. Lawrence run. The Furness Withy turboelectric liner for the Bermuda service also has taken the water, her name being decided upon as MONARCH OF BERMUDA, after several changes of idea. She and the two 20,000-ton turboelectric liners STRATHNAVER and and STRATHAIRD, which are under construction for the P. and O. company's Australian service have naturally attracted great attention to this system of propulsion, but it will probably be a long time before it is as popular in Europe as it is in the United States,

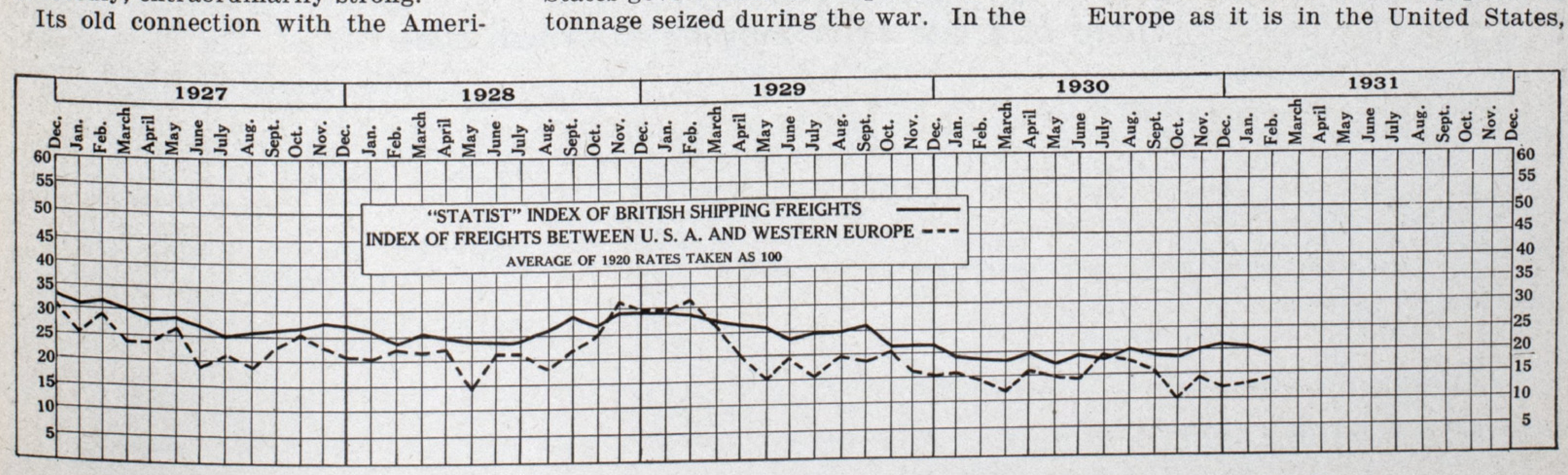

1927
1928
1929
1930
1931
Dec. Jan. Feb. March April May June July Aug. Sept. Oct. Nov. Dec.
60 55 50 45 40 35 30 25 20 15 10 5
"STATIST" INDEX OF BRITISH SHIPPING FREIGHTS
INDEX OF FREIGHTS BETWEEN U. S. A. AND WESTERN EUROPE
AVERAGE OF 1920 RATES TAKEN AS 100

Diagram Showing Fluctuation of Ocean Freight Rates for Four Years and Two Months

although it is practically certain that the new CIE-GENERALE TRANSATLANTIQUE liner will be fitted in that way. The new Pacific motorship REINA DEL PACIFICO has been commissioned.

The difficulties of insurance having been overcome by the assistance of the government, the new Cunarder now is making steady progress. The company covered £2,720,000 on the open London market at a rate unofficially reported as about 30s, leaving £1,780,000 to be covered by the board of trade under the agreement. It is proposed to build a big model of this new ship, capable of carrying two men below deck, and to take it to the United States to visit some of the principal cities which are accessible by water and so stimulate interest.

These new ships are all particularly interesting, but the trouble is that there is no sign of their being replaced on the stocks when they are completed and put in service. The unemployment situation in the British shipbuilding industry was bad enough when the last quarterly report was sent, but it is considerably worse now. The last day taken is Feb. 23, when the percentage of unemployed throughout the shipbuilding and ship-repairing industries was 49.5, no less than 24.9 per cent more than in February, 1930. At that time the North-East Coast was kept quite busy with a big batch of tanker orders from Continental owners, but that district now is one of the worst, with 59.1 per cent of its numbers out of work; it is beaten only by the South Wales district, which relies entirely on repair work and which is so affected by the number of cargo ships laid up that 67.8 per cent of its people are idle.

In Germany, shipbuilding conditions are not quite so bad, but they are bad enough, and there are an enormous number of skilled men without work. In the Howaldt yard at Kiel, which has a certain amount of Russian government work on hand, things have been relieved by reducing the working week from 48 hours to 40, permitting 1200 men to be employed instead of 1000, but at a sacrifice of one-sixth of their pay. This sacrifice, however, is practically made up by the local authorities at Kiel, who reckon that they save it by not having to pay the dole to the extra 200 men. For the circumstances ruling in the Howaldt yard it answers quite well, but it is to be feared that it would not be successful in other districts.

The Dutch yards have a certain amount of business on hand in the construction of motor cargo ships in the decision of the big companies to accelerate the main East Indian services. As most of the liners employed on this route now are motor driven, it means supplying entirely new diesel engines of higher power, the older ones being utilized for new cargo hulls. In addition, the bows and sterns of these accelerated ships have to be reconstructed, but in the case of the SLAMAT the routine is changed and she is given completely new ends on the Meier hull form, by which it is hoped to obtain the extra knot and a quarter required without interfering with the machinery at all. It may be mentioned that the Meier hull is attracting more and more attention and favor in European shipping circles.

Incidentally, there is the prospect of a certain amount of useful work coming to the British yards when the tanker market revives, owing to the success of the scheme which the Anglo-Saxon Petroleum Co. has evolved in conjunction with Palmer's, the Tyneside shipbuilders, for extending the life of spirit tankers by building an entirely new tank section instead of trying to repair the old one or scrap the ship.

The SARANAC and CADILLAC have been treated in this way up to now, by which it is reckoned that they will have another twelve years of life at least instead of being fit only for the scrappers, owing to corrosion, the cost being roughly half that of a new ship and the time off service being remarkably short.

The prospects of valuable Russian shipbuilding orders still are held out to the British yards, particularly on Clydeside, but this has been done so often before that it is a question whether the statements made are not purely political and not practical. Both German and Italian yards are doing a good deal of Rusian work, but in the Soviet Republic's own establishments progress is terribly slow, although it is admitted that some of the motorships which they are turning out are excellent vessels in every way.

Even with German and Italian help, the Soviet ship-owning department still is a very long way off its ambition to own all the tonnage necessary for moving the timber purchases by Britain, and there has been considerable trouble over the time chartering of the foreign tonnage necessary. Since the end of the last timber season the Soviet government has put forward most objectionable terms of contract, attempting to take full advantage of the present depression to force shipowners to accept conditions which are all against equity and established practice. Protests have been made with every body or association connected with British and most of those connected with Continental shipping, and members have unanimously decided to refuse to accept the terms. In spite of this a few have been taken up on them, and although they are mostly small and poor in quality, there is no doubt that some are owned by the revolutionists. There is little indication of Russia getting the tremendous tonnage that she requires for the movement of this year's timber sales, but once the shipowners' united front has been broken, there is always the possibility of a complete collapse.

To complete the tale of depression, even the Norwegian whaling business, which was making such colossal profits in the Antartic until this year, is faced with a slump. Practically all its catch has gone to one buyer, the Unilever group, and that now has announced that it will not take any whale oil during the coming season. That gives the alternative of laying up all the fleet or chartering unemployed tankers to store the oil in port in the hope of an improvement. Those who are apprehensive that the whale may be exterminated altogether by modern intensive methods are hoping that the former alternative will be chosen to reach an agreement.

Trend of Trade and Shipping in British Isles

	January	February	Two months ended Feb. 28 1931	1930
Total entrances of cargo ships into British ports:				
Number of vessels	3,854	3,662	7,515	8,187
Tonnage	4,508,297	4,008,683	8,508,764	9,074,793
Tonnage from Atlantic coast of North America	664,573	597,494	1,262,067	1,426,944
	(14.75%)	(14.95%)	(14.85%)	(15.75%)
Total clearances from British ports:				
Number of vessels	4,408	4,178	8,583	10,068
Tonnage	4,689,094	4,230,171	8,918,327	10,763,245
Tonnage going to Atlantic coast of North America	562,641	397,476	960,117	1,248,881
	(12%)	(9.35%)	(10.80%)	(11.70%)
Total value of goods:				
Exported	L43,601,026	37,645,884	81,246,910	127,007,215
Imported	L75,569,744	63,647,412	139,217,156	190,053,687
Exports of coal:				
Tons	3,271,331	3,532,286	6,803,617	10,229,067
Value	L2,563,035	2,871,289	5,434,324	8,769,043
Tonnage shipped for use of steamers	1,160,623	1,135,407	2,296,030	2,616,343

Lake Carriers Hold Meeting, Elect New President

By A. H. Jansson

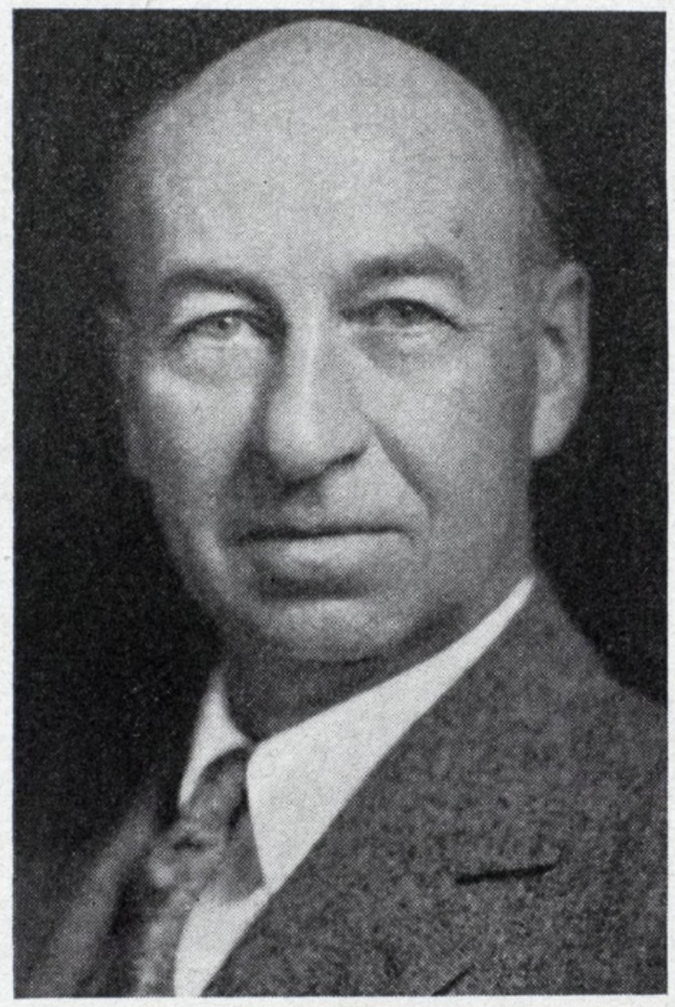
CAPT. JOSEPH S. WOOD, president of the Wilson Transit Co., is the new president of the Lake Carriers association. He was unanimously elected to this office to succeed J. S. Ashley at the annual meeting of the association held at the Hotel Hollenden, Cleveland, April 17. J. S. Ashley wished to retire from his office a year ago and was persuaded to continue at that time with the understanding that a chairman of the board would be elected who would relieve him of many of the usual duties of his office. This year, however, Mr. Ashley insisted on retiring and Captain Wood was elected president as active head of the association, the office of chairman being dispensed with.

Mr. Ashley has served the association with great skill and devotion since his election Nov. 18, 1925, to succeed William Livingstone, who had been president of the Lake Carriers association for nearly a quarter of a century until his death, Oct. 17, 1925. No man among the lake carriers is held in higher regard than John S. Ashley. He had served as vice president from 1915 until his election as president and he has been chairman of the advisory committee of the Great Lakes Protective association since it was founded in 1909 in which office he continues to be active. He started his career as local manager for the New York and Cleveland Gas Coal Co. in 1888 and until 1900 he was in charge of the movement of lake coal shipped by that company. Since January, 1900, he has been associated with the M. A. Hanna Co., since 1908 as manager of its fleet of vessels.

Captain Wood, the incoming president, began his career on the lakes as a watchman at the age of 19. Step by step he moved up, becoming master of Wilson Transit Co.'s ships at the early age of 24, the same line of which he is now the head. After 14 years as master he became marine superintendent. His next step was vice president and on the death of A. W. Thompson in 1928 he was elected to succeed him as president. He is also a director in the Great Lakes Towing Co.

Though now the directing head of an association the members of which control an American merchant fleet of 408 steel ships of 2,230,300 gross registered tons, he continues a master in good standing, entitled to serve in the capacity of captain on any American ship sailing the Great Lakes. He lives in Cleveland, is married, and has a family of four boys.

The annual meeting of the Lake Carriers association is not as a rule a particularly exciting affair and this year's meeting ran true to form. The annual report long since completed had been mailed to members and was duly ratified and approved at the meeting. The general counsel of the association, Newton D. Baker, presented a recodification of the by-laws, simplifying them and bringing them up to date, to conform with the new statutes of the state of West Virginia, under which laws the association is formed. The new draft of the by-laws as presented by Mr. Baker includes no changes of consequence from the former by-laws, except



Capt Joseph S. Wood
Elected President, Lake Carriers

the elimination of the office of chairman of the board, which was only a temporary change, and the active direction of the affairs of the association reverts back to the office of president.

A report of the shore captains committee by its chairman, Capt. R. W. England, again affirms the ready willingness in practically every instance of masters of ships to carry out the suggestions of the committee; one of the most important of these in recent years being the emphasis laid on strictly adhering to the up and down courses in order to avoid any possibility of collision. Captain England also called attention to the necessities this year of using the Middle Neebish channel in both up and down directions and that this might prove somewhat difficult for the younger officers who had never had any experience of it.

Other officers of the association were re-elected; and, outside of the change in the executive committee caused by the retirement of Mr. Ashley, the personnel of the association's directorate remains the same as a year ago. These changes are noted in the accompanying table of officers and directors corrected in accordance with the action taken at this annual meeting.

Low water, especially in Lake Erie, is again becoming a matter of serious concern. The Lake Erie levels for March are said to be 33 inches lower than a year ago, which is the lowest point—with the exception of 1926, which was but a shade under—in the 70 years that records have been kept. The abnormally low level of Lake Erie is laid to the exceptionally scant precipitation in these areas over a long period of time. The drafts will of necessity be less this year and to start the season may be limited to 18 feet 6 inches, as against an opening draft last year of 19 feet 9 inches.

No optimism at all is felt about the size of the tonnage to be carried on the Great Lakes this year. One operator feels that the figure for ore this year is not likely to reach the 40,000,000 tons mark. Compare this with 65,204,600 tons in 1929 and 46,582,982 in 1930. Other commodities, coal, grain and stone, it seems inevitable, are also bound to be less, so that the total net tons in iron, coal, grain and stone of 112,519,125 for the year 1930, which was the lowest year since 1924, will be something to shoot at, with but little hope of reaching or exceeding it. However, there were no visible signs of depression at the meeting, most everyone appeared tanned and cheerful looking from vacations in southern climes during the winter months.

One of the most important of the committees of the association is the welfare plan committee headed by George M. Steinbrenner. It is a committee that really functions actively in safety and welfare work among the officers and men on vessels of the lake carriers. Practical work is being done to eliminate accidents and to encourage thrift and advancement on the part of the men who operate the ships. In this connection Mr. Baker emphasized the immeasureably better conditions surrounding employment on vessels of the Great Lakes than on those engaged in ocean trade and that on this very account nothing was to be gained and much unnecessary interference will result, if the congress includes the Great Lakes in the laws governing the activities of ocean going seamen. The work of George A. Marr, vice president and secretary of the association, was highly commended by Mr. Baker.

Protective Association

THE Great Lakes Protective association, distinct from the Lake Carriers association but composed entire-

ly of members of that body, held its annual meeting in the afternoon on April 17 at the Hotel Hollenden, Cleveland. Either in person or by proxy 100 per cent of the membership attended the meeting. The advisory committee was re-elected without change. J. S. Ashley, as chairman, presented a brief summing up of the annual report, copies of which were sent to each member. The year 1930 is the twenty-second since the inception of the association, and it was the second year during which 50 per cent was reserved from conventional insurance by its members. The season of 1930 opened later than usual and no general start of the larger vessels was made until the last days of April. This was due to ice conditions that prevailed at Buffalo and in the upper rivers.

After May 1 nothing seriously affected navigation and good conditions prevailed well into fall. Though fogs were numerous and frequently of 24 hours duration there were no gales of destructive force. Due to these favorable weather conditions generally and strict observance of the separate courses for up and down bound traffic, not a single total loss was sustained by the association. Also other losses were below the average throughout the early part of the season and more than one-half of all the losses (60 per cent) occurred after Nov. 1. For the entire season a total of 69 losses were reported, and it is interesting to note the causes. Ten were from collision with other vessels in harbors, accounting for 1.57 per cent of the whole loss; one collision in Bar Point channel represented 11.36 per cent; 16 groundings and striking obstructions in harbors represented 38.64 per cent; seven groundings and striking obstructions in rivers and channels amounted to 22.72 per cent; 31 cases of striking fixed objects in harbors and channels amounted to 20.29 per cent of the whole loss. The total is a noticeable reduction over the season of 1929, when 135 losses were reported. Only one loss was due to stress of weather, and this occurred on Dec. 2, after the normal close of navigation. While the number of groundings in harbors is about the same as in the previous year, greater loss resulted, due to the sharp recession in water levels toward the end of the season, making the effect of groundings more serious.

Losses Smaller in Number

The year as a whole showed a smaller number of losses than in most years and even though some of these losses were heavy the indications as the annual report was prepared were that there will be a return to subscribers of something around $160,000 out of their initial contribution. If these estimates prove to be accurate, the cost rate in the association will be about 2 per cent on the value reserved to cover all risk, including the period of navigation, pre-season, post-season, port risk, special trips and all other such risks.

The most significant lesson from the operations of 1930 is the seriousness of damage due to groundings in and about harbors on account of low water. In all, accidents of this nature resulted in a loss of $265,000, while groundings in rivers and channels represented a loss of $156,000. The chairman emphasized the need of extraordinary care on the part of masters of ships. With such care many of the accidents reported could have been avoided. A moment's lack of vigilance on the part of the navigator, experience shows, can be very costly to the owner. The third category of striking fixed objects accounted for a loss of $140,000, and most of these also the chairman pointed out could have been avoided with proper precautions.

The financial statements show that the year 1925 proved profitable to the subscribers, $167,000 being returned after paying all obligations. The year 1926 indicates a return of about $58,000; for 1927 the surplus is estimated at around $62,000; for 1928 about $93,000; and for 1929 about $63,000.

The advisory committee was re-elected without change: J. S. Ashley, chairman; A. E. Cornelius, R. W. England, A. F. Harvey, C. L. Hutchinson, J. T. Kelly, F. I. Kennedy, H. K. Oakes, C. J. Peck, A. R. Schneider, Geo. M. Steinbrenner and R. B. Wallace. Officers, to be appointed later, will undoubtedly continue to be as heretofore: J. S. Ashley, chairman; Geo. A. Marr, secretary; R. W. England, treasurer; J. A. Armstrong, assistant treasurer, and Robert G. McCreary, counsel.

Carriers Hold Annual Banquet

The annual banquet of the Lake Carriers association was held at the Hotel Hollenden on the evening of April 17. J. S. Ashley, the retiring president, presented the eminent counsel of the association, Newton D. Baker, to act as toastmaster. The main feature of entertainment was an address by Chas. E. Lofgren, personnel officer of the Byrd antarctic expedition, on the human side of this adventure. The talk was illustrated by pictures of the life at Little America.

Mayor John D. Marshall of Cleveland told of the progress in the work now under way to improve navigation on the Cuyahoga river. Mr. Baker, in what seemed a remarkably sane and clear view of the universal business depression, concluded that from a layman's point of view it would seem that improvement in conditions will not long be delayed. Nothing whatever was said at the dinner concerning the possibilities of the falling off in the tonnage to be moved this year.

Officers

Lake Carriers' Association

President
JOSEPH S. WOOD

Vice President
L. C. SABIN

Vice President
Secretary and Treasurer
GEORGE A. MARR

General Counsel
NEWTON D. BAKER

Executive Committee

A. E. Cornelius, J. C. Evans, A. F. Harvey, C. L. Hutchinson, H. K. Oakes, A. E. R. Schneider, W. G. Stewart, G. A. Tomlinson, George H. Warner, H. S. Wilkinson.

Alternates

J. Burton Ayers, J. J. Boland, H. G. Dalton, A. H. Ferbert, Warren Jones, John T. Kelly, James McAlpine, Walton H. McGean, W. P. Schaufele, A. C. Sullivan.

Directors

Cleveland

J. S. Ashley, J. Burton Ayers, Newton D. Baker, S. B. Cady, C. C. Canfield, H. D. Dalton, R. W. England, A. H. Ferbert, A. F. Harvey, C. L. Hutchinson, Chas. O. Jenkins, Warren C. Jones, John T. Kelly, Geo. S. Kendrick, F. I. Kennedy, Geo. A. Marr, Walton H. McGean, H. K. Oakes, R. J. Paisley, C. J. Peck, L. C. Sabin, W. P. Schaufele, A. E. R. Schneider, Geo. M. Steinbrenner, W. G. Stewart, H. C. Strom, Baird Tewksbury, G. A. Tomlinson, R. B. Wallace, Geo. H. Warner, Joseph S. Wood.

From Other Cities

J. J. Boland, A. E. Cornelius, J. C. Evans and J. E. McAlpine of Buffalo; H. F. Hughes and A. C. Sullivan of Chicago; J. G. Munson of Rogers City; W. P. Snyder, Jr. of Pittsburgh and H. S. Wilkinson of New York.

American Vessels Lead in Great Lakes Shipping

American flag ships made up 80 per cent of the number and 85 per cent of the tonnage of Great Lakes vessels of 2000 gross tons and over on Jan. 1, 1931, according to a report issued by the bureau of research, United States shipping board.

A total of 555 vessels of 2,760,914 gross tons was recorded as available for operation on the above date, of which 444 vessels having a tonnage of 2,350,167 gross tons were American and 111 vessels having a tonnage of 410,747 gross tons were British or Canadian. The American vessels in this service had an average of 5300 gross tons each, and the foreign vessels an average of 3700 tons.

The vessels of the Great Lakes fleet make up the largest group of vessels in the world operating on fresh water, and the cargo moved has exceeded 190,000,000 tons in a single year. The navigation season on the Great Lakes usually extends over about eight months of the year, beginning between the first and fifteenth of April and closing about the fifteenth of December.

Of the 506 freighters, representing 91 per cent of the total number of vessels in operation, 419 were American and 87 British. There were also 38 combination passenger and freight vessels.

Saving Waste Heat in Diesel Engines

Ten Per Cent of Engine Power Can Be Recovered from Exhaust—Apply Engineering Methods—Steady Improvement—Commercially Practical

By F. Johnstone Taylor

DESPITE the perfection of present day prime movers, and especially the oil engine, heat engines are machines of relatively low thermal efficiency. The steam engine and steam turbine cast away a large proportion of the available heat in the fuel into the condenser, while the internal combustion engines does the same, though in a lesser degree in the exhaust gases and the cooling water. The turbine builders have improved matters somewhat by means of the regenerative condenser, while in the case of the oil engine, apart from such devices as exhaust turbo superchargers and the more or less restricted combined steam-oil engine of the Still class, the principal direction in which waste heat can be recovered and turned to good account lies in the exhaust heat boiler.

Such an arrangement is quite obvious and for that matter is by no means novel; it was applied many years ago by the Cockerill company of Seraing, Belgium, who have made a success of it in connection with blast furnace gas engines, some 10 per cent of the potential engine power being thus made available in the form of electrical energy generated by a steam turbine. As these engines average 10,000 horsepower or so the added power is considerable, while the plant for producing it is relatively cheap.

In the case of oil engined vessels, some make use of electrically driven auxiliaries, the power being economically furnished by diesel driven generators. At the same time steam is always useful on board ship and may be essential in many instances such as where perishable cargo has to be kept warm or for heater coils in oil storage spaces and in general the exhaust gas boiler for providing steam for general purposes and for steam driven auxiliaries and deck machinery is a sound practical proposition.

Some 30 per cent of the total heat in the fuel passes through the exhaust valves of an oil engine, though in the case of the two cycle engine the gases are appreciably cooler on account of their admixture with scavenge air. The average temperature in the former case can be taken as 725 degrees Fahr. and in the latter at 525 degrees Fahr. Under average conditions with steam generated at say 90 pounds, the gases would be cooled to about 400 degrees and the proportions of available heat in the steam would be 54 per cent in the case of four stroke engines and 37 per cent in the case of two stroke. Assuming in each case a fuel consumption of 0.4-pound per brake horsepower per hour, the four stroke engine can recover some 1800 B.t.u.'s and the two stroke engine about 1200. Converted in pounds at and from 212 degrees Fahr. these figures become 1.22 and 0.84 respectively and these can be taken as representative figures for both types of engines.

According to Major Gregson, who deals with the subject very fully in a recent paper read before the Diesel Engine Users' association of London, the following figures may be regarded as typical:

Four Stroke Engine at Full Load

Fuel consumption. 0.4 lbs. B. H. P./hr.
Waste gas temperature T_1 = 740 Degs. F.
Boiler pressure 160 lbs.

Corresponding temperature of saturated steam = 370 Degs. F.
Suitable waste gas temperature leaving boiler, 370 Degs. F., plus say 70 Degs. F. = 440 Degs. F. = T_2.
CO_2 in waste gases .....6¾ per cent
∴Corresponding excess air.....125 per cent
Radiation, etc., loss (say).....5 per cent
∴Boiler efficiency.....100 — 5 = 95 per cent
Weight of gases per lb. of oil corresponding to 125 per cent excess air = 15.14 plus 17.7 = 32.84 lb.
B.t.u.'s recovered by boiler per b.h.p. per hour = weight of gases per hour × temperature drop degrees F. × specific heat × 0.95.
Take specific heat between limits of temperature worked to = 0.24.
∴B.t.u.'s/b.h.p./hour = .4 × 32.84 × (740 — 440) × .24 × .95 = 900.

$$\therefore \text{Steam/b.h.p./hour} = \frac{900}{966} = 0.93 \text{ lb. from}$$

and at 212 degrees F.

Two Stroke Engine at Full Load

Fuel consumption.....0.4 lb./b.h.p./hr.
Waste gas temperature at boiler = T_1 = 550 degrees F.
Boiler working pressure.....35 lb. per sq. in.
Corresponding saturated steam temperature .....280 degrees F.
∴Suitable waste gas temperature leaving boiler.....= T_2 = 280 plus 70 = 350 degrees F.
CO_2 in waste gases.....5 per cent
∴Corresponding excess air.....200 per cent
Radiation loss.....= (say) 7½ per cent (larger boiler for given output than on four-stroke engine).
∴Boiler efficiency .....92½ per cent
Weight of gases per lb. of oil = 15.14 plus 28.32 = 43.46 lb.
B.t.u.'s/b.h.p./hour recovered by boiler (same formula as for Case 1)—.4 × 43.46 × (550 — 350) × .24 × .925 = 770.

$$\therefore \text{Steam/b.h.p./hour} = \frac{770}{966} = 0.8 \text{ lb. from}$$

and at 212 degrees F.

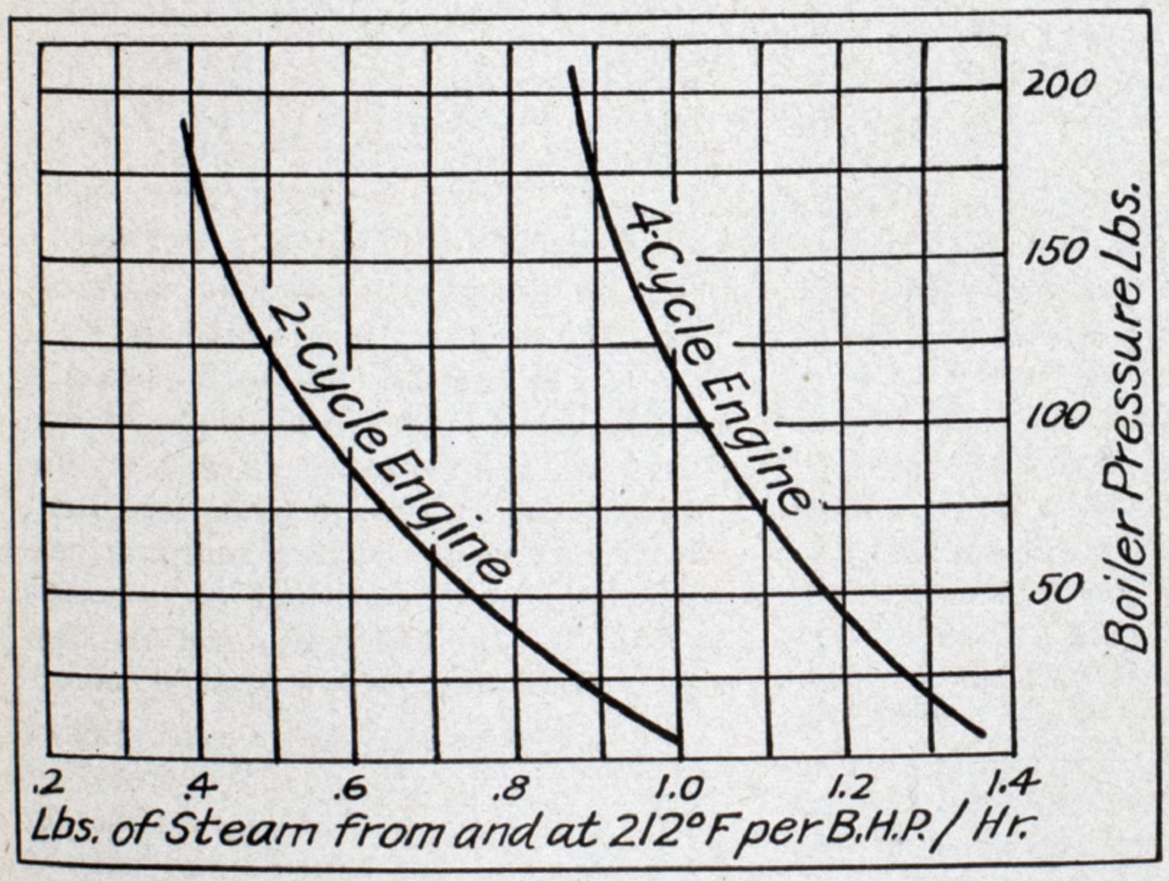


Diagram showing theamountofsteam per horsepower per hour it is possible to recover through use of waste heat boilers on diesel engi ed ships using the heat of exhaust gas as fuel. Also influence of boiler pressure on final steam yield

The influence of boiler pressure on final steam yield will be particularly noted in the accompanying diagram:

The above considerations assume of course that the engine is on full load. If it is on part load, the initial temperature T_1 is lowered and the rating has to be adjusted in accordance with the expression

$$s = S \times \frac{T_f - T_2}{T_1 - T_2} \times \frac{V_f}{V_1} \times \frac{W}{W_1}$$

where S=the normal steam at full load in pounds from and at 212 degrees Fahr., s the steam at the lower load, T_1 and T_2 as before, V_1 and V_f the respective volumes assessed from CO2 figures and W_1 and W_f the respective fuel oil rates per brake horsepower per hour.

It might be assumed that by adding a feed heater to the boilers that even more heat could be abstracted. That might be the case, but in practice this has been found an objectionable arrangement on account of the low temperatures inducing sweating and this moisture combining with the sulphur in the exhaust gases setting up troublesome corrosion.

Whether the engine is large or small, rough and ready methods of raising steam or heating water by passing the exhaust gases through boilers of amateur design or originally intended for coal firing are very little use, because the recovery of waste heat is a definite problem. The temperature of the exhaust gases from engines is considerably below that encountered in direct fired boiler practice so that the bulk of the heat which is abstracted from the gases in a waste heat boiler must be conveyed to the water by a process of convection. In this case the heat transferred per unit of time and surface is relatively small and for a given duty a very large heating surface is essential. Thus the practical condition of heat absorption by convection calls for a high gas velocity.

In case of tubular boilers the smaller the diameter of the tube through which the hot gas is caused to pass, the closer are the gas molecules to the surface, the sooner will they reach that surface and the greater will be the number of contacts they will make with it in a given period of time.

This constitutes the underlying principle of the Kirke waste heat boiler which is extensively used in one form or another with large gas engines. It is for all practical purposes a locomotive type of boiler with a large number of long small bore tubes through which the gases are drawn at high velocity by means of a fan.

Waste Heat Boiler Characteristics

In the case of marine diesel engines the chief characteristics of a waste heat boiler are according to the Foster Wheeler Corp., who specialize in this class of equipment.

(1) The boiler must be capable of absorbing heat from exhaust gases at very low temperature.

(2) The boiler must be so designed as to permit of independent firing when the main engines are stopped.

(3) It must be so designed that it will not be damaged by the hot gases should it contain no water and that it will not leak or show other signs of distress under intermittent operation of the engine.

(4) It ought for preference to function as a silencer and it must not create back pressure or be subject to the attack of corrosive gases.

This company's waste heat boiler embodies a special feature in the shape of the gilled tubes, which are steel tubes with cast iron protecting rings. These are claimed to provide adequate protection against any possible ill effects of corrosive elements in the exhaust gases and in addition to afford a very large heating surface in a confined space. This heating surface is contained in a cast iron housing and all the tube joints are outside it. The heating surface is arranged in two sections which are connected to a horizontal steel drum fitted with the usual boiler mountings. The feed water is delivered through the upper section in which it is heated before entering the drum and the steam is raised in the lower section through which the water circulates to and from the drum. The elements of the heating surface are horizontal.

With the elements of each horizontal row closely spaced together, the gases flowing over the heating surface are successively restricted and expanded and this gives the necessary silencing effect. The oil burner at the base of the boiler maintains steam when the engine is not in use. There are no steam joints in contact with the gases, the elements being expanded into the tube sheet before connecting up the flange joints. While the soot blower is an essential part of the equipment, the boiler normally keeps quite clean by the blast of the waste gases. According to data furnished by the makers a boiler of this class working in conjunction with a 4000-horsepower M. A. N. engine (two cycle) evaporated 0.7 pounds of water per brake horsepower per hour.

The Cochran boiler is in good repute in Great Britain as being one of the most efficient vertical boilers built and recently this firm has applied the general design to the raising of steam by the exhaust gases of marine diesel engines. This boiler is furnished with two upper nests of tubes for the waste heat recovery and a lower nest of tubes for oil firing. The latter are in direct communication with the furnace and all the tubes are secured between two common tube plates. In the upper nest there are, in one particular size of boiler which is standardized to meet a good many requirements, 311 1½-inch outside diameter tubes and 41 stay tubes. In the middle section there are 297 tubes of the same size and 55 stay tubes, while those in the lower portion are 2½-inch diameter. There are 102 of these and 29 stay tubes. With 1890 square feet of tube surface, these boilers are claimed to be capable of furnishing 0.80-pound of steam at 100 pounds per brake horsepower per hour of the engine.

The Clarkson thimble tube boiler has been universally successful in connection with waste heat recovery and not only is it suitable for relatively large engines, but it can be well applied to small semidiesel units on trawlers, etc., with advantage. Its essential features are an arrangement of inwardly projecting tubes of "thimble" form against which the gases impinge at high velocity. This creates the essential turbulence of the gases outside the tubes while within them there is a percussive circulation of the water which keeps them clear of deposit at all times. In fact even with hard water it is claimed that a daily blow down and a periodical wash out serves to keep these boilers in good condition for an unlimited period, as the tubes rarely if ever leak or call for re-expanding. This is largely because there is a complete absence of expansion due to heat while the carbon deposit on the tubes can be burned off when the boiler is shut down.

A further development lies in the "duplex" type. This type of boiler was first installed in the motor trawler SAINT MARTIN LEGASSE in conjunction with a Polar engine of 700 horsepower. There are two separate thimble tube units enclosed in a common boiler shell, the overall height being 12 feet 2 inches and the diameter 4 feet 3 inches. The top unit is arranged to deal with the exhaust gases from the engine. They pass down through the nest of water filled tubes and return through a central outlet pipe. The heating surface is 108 square feet and with an assumed gas temperature of 480 degrees Fahr. some 300 pounds of steam per hour is generated at 75 pounds pressure. The bottom unit is designed for simultaneous or independent oil firing by means of a Wallsend Howden low pressure burner. It is arranged to fire vertically upward within a combustion chamber formed of refractory material and so arranged that the hot gases pass down through a nest of water filled thimble tubes. The heating surface is 180 square feet and it has an output of 800 pounds of steam per hour. A good feature of the design is the well submerged crown of the lower unit which is halfway down the boiler as measured from the normal water level. If desired the top unit can be run dry as a silencer if no steam is wanted and the combined output is 1100 pounds of steam at 75 pounds. The boiler has all the usual steam fittings.

Another type is known as the Clarkson electric boiler and it is somewhat novel. In place of the more usual oil burner for use in port, there are electric elements supplied with current from the ship's sets.

Practical Working Condition

It is hardly necessary to point out that an exhaust gas boiler is bound to be a commercial proposition because when the engines are running the heat supplied to it would otherwise pass away through the uptake. Normally such boilers could be used to the best advantage in supplying steam for the generator sets. Assuming a normal type of diesel generator to be using 0.5-pound of oil and developing say 260 horsepower, that means 130 pounds of oil per hour or 1.4 tons per day, the cost of which can be definitely saved, which will mean in a diesel ship using 14 tons per day a reduction in overall fuel consumption of 10 per cent. If steam was required for this or other purpose it can be put to further use. For instance on the M. V. OTAIO, the steam from the exhaust gas boiler to the extent of 6000 pounds at 100 pounds pressure operates a 160-kilowatt generating set and then passes out at 5 pounds for accommodation heating, and evaporating, etc.

Empress of Britain is Nearing Completion at Clydebank

ADVENT of the new Canadian Pacific liner EMPRESS OF BRITAIN, which will leave Southampton on her first voyage to Quebec on May 27, is arousing greater interest than the entry into service of any other British-built Atlantic vessel since 1914. With her gross tonnage of about 42,500, not only will the new liner be the largest, swiftest and most luxuriously appointed ocean-going vessel to ply between any two ports in the British Empire, but her propelling machinery represents the latest and in many respects the most outstanding example of high pressure and high temperature steam practice in the world's mercantile marine. (See photo on page 19).

The EMPRESS OF BRITAIN was launched on June 11, 1930, at John Brown & Co. Ltd., Clydebank, Scotland. She is by far the largest ship built for the Canadian passenger trade and also the speediest. An average sea speed of 24 knots is to be maintained when she enters the Southampton-Quebec service of the Canadian Pacific Steamships, Ltd.

Her length overall is 758 feet; length on the load waterline, 755 feet; length between perpendiculars, 730 feet; beam molded, 97 feet 6 inches; depth to B deck 60 feet 9 inches; load draft, 32 feet and gross tonnage, of about 42,500. Passenger capacity is 452 in first class; 260 in tourist class and 470 in the third class. The Prince of Wales was the sponsor at the launching. No pains are being spared to make her one of the finest transatlantic liners. First class staterooms have been arranged for one and two passengers each. Seventy-five per cent of the first class staterooms have either a private bath and toilet or shower and toilet. There are two de luxe suites of rooms, comprising a sitting room, bedroom, veranda, bathroom, separate toilet and a large box room. There are 18 special staterooms for two persons, each room having its own private bath and toilet. Bedsteads of large size are fitted in all first class staterooms.

One of the Great Liners

From all this it will be seen that in size, in speed and in luxury of passenger accommodations the EMPRESS OF BRITAIN will take second place to very few of the vessels of the world.

The progressive policy of the Canadian Pacific line in creating during the last six or seven years a large and up-to-date fleet of ocean steamships of all classes, for both passenger and cargo-carrying services, has involved new construction and the re-engining of existing vessels on an unprecedented scale. Not the least inducement to embark on this expenditure of many millions sterling, which has culminated in the building of the EMPRESS OF BRITAIN, was provided by the economies in the cost of propulsion and operation which John Johnson, the company's chief superintending engineer, was able to offer through his new conceptions of high pressure steam practice. It may be recalled that the Duchess passenger steamships of the Canadian Pacific line attained a fuel economy of 0.625 pound of oil per shaft horsepower per hour for all purposes, and still more recently the same owner's EMPRESS OF JAPAN set up a world record of 0.603 pound for all purposes. It is anticipated in technical circles that this record will be surpassed by the latest and largest Empress.

The hull of the EMPRESS OF BRITAIN, has been constructed by John Brown & Co. Ltd., Clydebank; and the same company has also built and installed the main engines, gears and boilers under Mr. Johnson's care.

Four Propellers Are Used

The vessel is propelled by four screws, each driven by an independent set of single reduction geared turbines of the Parsons type. To suit the conditions under which the ship will run, viz., voyages between Great Britain and Canada during the summer and world cruises during the winter, the engines driving the two inboard screws are designed to develop two-thirds of the total power, while the engines driving the two outboard screws develop the remaining one-third. In other words, the power of the outboard engines is only one-half that of the inboard engines. Under cruising conditions, if full power is not required, only the inboard engines will be used, and the vessel will then be twin screw.

The machinery has been designed to develop normally a total output of 60,000 shaft horsepower continuously at sea, in order to maintain a normal speed of 24 knots. If an increase of speed is necessary at any time, however, an overload power of 64,000 shaft horsepower can be maintained for long periods.

Two engine rooms are necessary for the main propelling machinery, the two inboard sets being arranged in a compartment forward of that in which the two outboard sets are installed; while certain of the auxiliary machinery, which will be described later, is situated in a separate auxiliary engine room immediately forward of the two main engine rooms.

The main turbine sets each comprise one high pressure, one intermediate pressure and one low pressure turbine, working in series; and each turbine drives a separate pinion, which engages with the main gearwheel. For astern running, a high pressure unit is incorporated in the same casing with each of the two intermediate ahead turbines and a low pressure unit in the exhaust end of each of the two low pressure ahead turbines of the inner shaft machinery only. No provision is made for astern working on the outer shafts, which are employed exclusively for ahead duty. The astern turbines are capable of developing 60 per cent of the aggregate ahead service power.

High pressure turbines are all constructed to withstand a maximum working pressure of 425 pounds per square inch and an initial steam temperature of 725 degrees Fahr., but they have been designed to develop the service and overload powers when employing steam between the limits of 375 pounds per square inch (gage) and 0.50 pound per square inch (absolute), with an initial steam temperature of 700 degrees Fahr.

Turbines of Impulse-Reaction Type

The high pressure ahead turbines are of the impulse-reaction type, comprising a two-row velocity wheel with blades of stainless steel, and a reaction portion fitted with end-tightened blades of Monel metal. Nozzle control valves are fitted to enable a gradual increase of power to be obtained, while at the same time maintaining as high a pressure as possible in the control chest for quick operation. The intermediate pressure ahead turbines are of the reaction type throughout, with end-tightened blades of phosphor-bronze. The low pressure ahead turbines are also of the reaction type, with phosphor-bronze blades.

High pressure astern turbines each consist of a three-row impulse wheel, while the low pressure astern turbines each have two impulse wheels with two rows each, in which the blades are of stainless steel.

To eliminate vibration, all the rotors have been dynamically balanced. The low pressure ahead turbines are of the double flow balanced type, and each of the other turbines is fitted with a dummy to reduce the end thrust due to the difference in steam pressure. Michell thrust bearings of the spherical seated type are fitted to each rotor to take up any remaining axial thrust. Owing to the high steam temperature employed, the turbine casings are of cast steel, with the exception of the low pressure casings, which are of cast iron.

To facilitate the lifting of the upper portions of the turbine casings,

the receiver pipes have been connected to the lower halves of the turbines in every case. Emergency connections have been fitted, so that any of the turbines can be cut out if this should be found necessary.

In each set the high pressure turbine is fitted with an Aspinall patent governor combined with a fore and aft indicator and control, while the intermediate pressure and low pressure turbines are fitted with fore and aft indicators and controls only. With this arrangement, the steam would be shut off in the event of the turbine speed exceeding a certain limit. The fore and aft indicators show any axial movement of the turbine rotors; and should the wear on the thrust pads make this movement excessive, the control would then operate and shut off steam.

Steam would also be shut off in the event of the oil pressure in the lubricating system dropping unduly or failing entirely.

The main condensers, which are of the Weir two flow regenerative type, with a large reservoir at the bottom for storing the water required for the successful operation of the closed feed system, are slung underneath the low pressure turbines. Each inboard condenser has a cooling surface of 20,700 square feet, the tubes being ¾-inch in diameter and 14 feet 6 inches long; while each outboard condenser has a cooling surface of 9600 square feet, with ¾-inch diameter tubes 11 feet 6 inches long. The tubes for all the condensers are made of cupro-nickel.

A particular feature of the condensers is the water doors, which have been designed to facilitate the quick examination of the tubes. Large hinged doors have been fitted in each end, and these are jointed with rubber rings recessed into the casing. The doors are secured by swivel bolts and dogs, which may be removed for inspection purposes in a few minutes.

Gearing, Propellers and Boilers

The main gearing is of the usual double helical, single reduction type, and the main gearwheels of the inner and outer shafts have diameters of 14 feet 6 inches and 11 feet 3½ inches respectively. All the pinions are connected to their respective rotors by flexible claw type couplings. The gearwheels and pinions are enclosed in strong cast iron gear cases.

The thrust of the propellers is transmitted to the vessel through Michell thrust bearings of the single collar type, fitted to the main lines of shafting immediately aft of the gearing; and the tunnel shafting is supported by bearings of the Michell pivoted pad journal type.

The propellers, which are of solid bronze, have diameters of 19 feet 3 inches and 14 feet for the inner and outer shafts respectively. When developing the normal service power of 60,000 shaft horsepower, the speeds of the propellers are 150 and 200 revolutions per minute and the corresponding speeds of the turbines are 1365 and 1795 revolutions per minute for the inner and outer shafts respectively. The reduction ratio, therefore, is about 9 to 1.

The boiler installation consists of eight oil fired water tube boilers of the Yarrow type and one oil fired water tube boiler of the Johnson type. The boilers are arranged in two compartments, and the same principle of division of power has been carried out in the boiler arrangement as with the main engines.

Six of the boilers are placed in the after boilerroom, normally supplying the forward inboard engines; while three boilers are installed in the forward boilerroom, supplying the outboard engines in the after engineroom. The arrangements are such that any or all of the boilers can supply the ahead and astern turbines in the forward engineroom.

The Yarrow boilers are of the double flow side fired type, having one steam drum, three water drums, and one superheater drum. The flow of the gases is through both sides of the boiler, after which it passes through a large tubular air heater and thence to the funnel.

The boiler and superheater drums are hollow rolled forgings with ends formed integrally, and represent the latest practice for high pressure boiler work.

The Johnson boiler consists of two large-diameter drums, placed vertically one above the other and connected to each other by curved tubes which are arranged longitudinally and across the ends in such a manner that the combustion space is almost entir eenclosed by water tubes. In addition, there is a wall of water tubes along the center of the boiler, which divides the combustion space into two separate compartments. This arrangement of tubes provides for a considerably larger amount of tube surface exposed to radiant heat than in other types of marine water tube boilers.

The boiler was constructed at Clydebank and a series of very complete trials showed that it is capable of generating double the amount of steam per square foot of heating surface, while registering the same efficiency as a Yarrow or other standard type of boiler worked at ordinary mercantile rating.

Supreme vortex steam dryers have been fitted to the boilers in the after boilerroom, while tangential steam dryers are installed in the boilers in the forward room. Each main boiler is fitted with two automatic feed regulators, one of the Weir and the other of the Mumford type, while Parry soot blowers are also provided. In order to give the alarm when the water in the boilers falls below a predetermined level, Mumford low water alarm gear has been installed.

In the forward boilerroom there are also two cylindrical boilers of the return tube for domestic and other auxiliary purposes. These boilers are arranged to burn oil fuel with the Howden system of forced draft, and are designed for a working pressure of 200 pounds per square inch. The oil fuel pumping and heating installation is of the Wallsend-Howden type.

Diesel Electric Generating Plant

In the separate compartment between the forward main engineroom and the after boilerroom are situated four Fiat British diesel engine-driven generators.

Each of these generators, which has an output of 450 kilowatts is driven by a Fiat British single acting, two stroke cycle, four cylinder engine developing 660 brake horsepower at 260 revolutions per minute, and each driving its own double-acting scavenging pump, three stage air compressor, circulating water pump and lubricating oil pump.

For emergency use and for supplying the starting air, there is a Reavell electrically driven compressor, and in the auxiliary engineroom there are also two fuel oil transfer pumps.

In addition to the diesel engine-driven generators, there are two British Thomson-Houston turbo-driven generators of 800 kilowatts each. These are situated in the forward main engineroom and are supplied with high pressure superheated steam from the main boilers, the exhaust being connected directly to the condensers. The turbo-driven generators are driven at 670 revolutions per minute through gearing, the turbines running at 6000 revolutions.

The remaining auxiliaries, which are mostly electrically driven, are arranged in three pairs, so that one pair will serve each of the larger main engines and the remaining pair the smaller outboard sets.

The Weir closed feed water system comprises electrically driven centrifugal extraction pumps, feed pumps of the turbo-driven centrifugal type, and the necessary filters and primary and secondary heaters.

The Drysdale main circulating pumps are of the vertical-spindle centrifugal type, driven by electric motors. Nine Drysdale centrex pumps have been supplied for the forced lubrication system, and Vickcen centrifugal separators are installed for the purification of the lubricating oil.

On her preliminary trial trip in the open sea off Wemyss bay on April 6, the new liner averaged between 18 and 20 knots with engines not open. The ship is expected to do better than 24 knots.

Merchant Marine Academy

By Arthur M. Tode, Member, Board of Visitors,
New York State Merchant Marine Academy

THAT America is again turning to the sea in a vigorous fashion has been demonstrated so poignantly the past three years, that no longer does room for doubt remain as to the future of our maritime trade. Among the subjects brought forth for discussion at the Fourth National Merchant Marine conference at Washington in January, none aroused a deeper interest, was more widely discussed or received more publicity than the training of merchant marine officers. More than 1700 questionnaires which had been mailed and returned were carefully tabulated by the committee, details of which have already been published. The results of these tabulations clearly indicated the trend for a national merchant marine academy or its equivalent; an institution whose facilities would be available to American youths from all the several states.

So much has already been written of the work of the four state training ships, the NEWPORT, the NANTUCKET, the ANNAPOLIS, and the CALIFORNIA STATE that repetition is not required here. The state of New York was the first to have its governor request the loan of a vessel for training purposes from the navy department under the law of 1874. The U. S. S. ST. MARYS was at that time loaned and became the New York Nautical school. The empire state has now acquired from the navy department a modern vessel for the training of merchant marine officers and on April 6 its legislature passed an act amending the education law in relation to admission to the New York State Merchant Marine academy.

Under date of March 25, 1931, Governor Franklin D. Roosevelt wrote to the secretary of the navy, regarding better training facilities for the young men enrolled in the academy, requesting that the U. S. S. PROCYON with complete equipment be loaned to the state of New York for use as the training ship of the academy to replace the NEWPORT. The secretary of the navy under date of April 3 advised Governor Roosevelt that the department would be able to comply with the request and further, that when recommissioned, the name would be changed to the U. S. S. EMPIRE STATE.

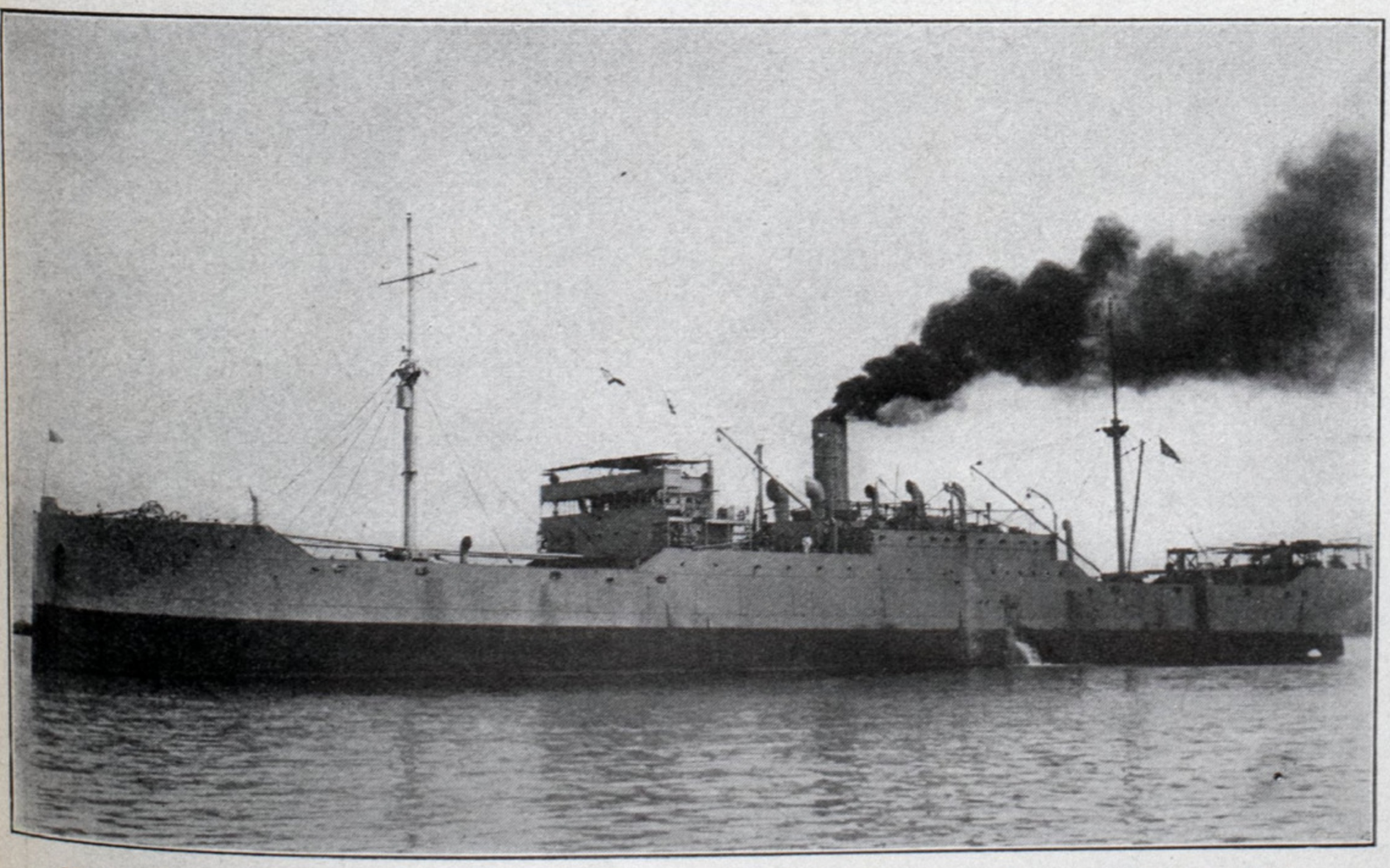
The acquisition of the EMPIRE STATE for the training of merchant marine officers will be widely acclaimed. The consensus of opinion in maritime circles has been for a training ship which would combine cargo and passenger carrying characteristics. The new vessel will fulfill the requirement and for the first time in the history of training merchant marine offices, cadets will be trained on a modern ship with all modern equipment. Cadets from states other than New York state who enter the academy will be required to pay approximately $750 per annum for tuition and board, plus $90 per annum for uniforms, textbooks and minor equipment. The course at the academy is two years and the cadets successfully completing the course are graduated and licensed as third mate or third assistant engineer, and obtain immediate employment. The educational qualifications for admission to the academy require the candidate to have completed three years of high school work, and a large percentage of those at present enrolled are high school graduates.

Great credit for the securing of the new vessel is given to the superintendent of the academy, Capt. J. H. Tomb, U. S. N. (retired), and to Governor Franklin R. Roosevelt. Not only did Governor Roosevelt and Capt. Tomb persuade the New York State Education department, which has jurisdiction over the Merchant Marine academy, but also gained the support of the New York State chamber of commerce and the state legislature in this movement, which not only results in a modern ship, but also permits all American boys for the first time in history the opportunity for obtaining merchant marine training at the New York State Merchant Marine academy.

The U. S. S. NEWPORT will leave the Brooklyn navy yard for her last cruise about May 14 and head for the Puget Sound navy yard at Seattle, via the Panama canal. Some time in July she will be decommissioned and the cadets and crew transferred to the U. S. S. PROCYON which will then be named the EMPIRE STATE. This vessel was decommissioned at the Puget Sound navy yard on March 31, and is in splendid shape in every way. Until last month she was flagship of Rear Admiral William D. MacDougall, commander of the base force and a few years ago was commanded by Rear Admiral W. W. Phelps, commandent of the third naval district and the Brooklyn navy yard.

The new training ship of the Merchant Marine academy is 401 feet long, 54 feet beam, 24½ feet norma' draft, and has a normal displacement of 11,450 tons. She is engined with Curtiss type, General Electric geared turbines of 2500 horsepower, which give the vessel a speed of 11½ knots. She is boilered by three Babcock & Wilcox oil burning boilers and lighted by two 50 kilowatt 120 volts turbogenerators. Her complement as a naval ship was 27 officers and 191 men.

There is already a lengthy list of applications to be acted upon for the next examinations for entrance to the New York State Merchant Marine academy, which will be held in September. It is expected to accommodate 200 cadets on board the EMPIRE STATE. Full information regarding the qualifications for admittance to the academy can be obtained by addressing the Secretary, New York States Merchant Marine academy, Room 874 Centre Street, New York.

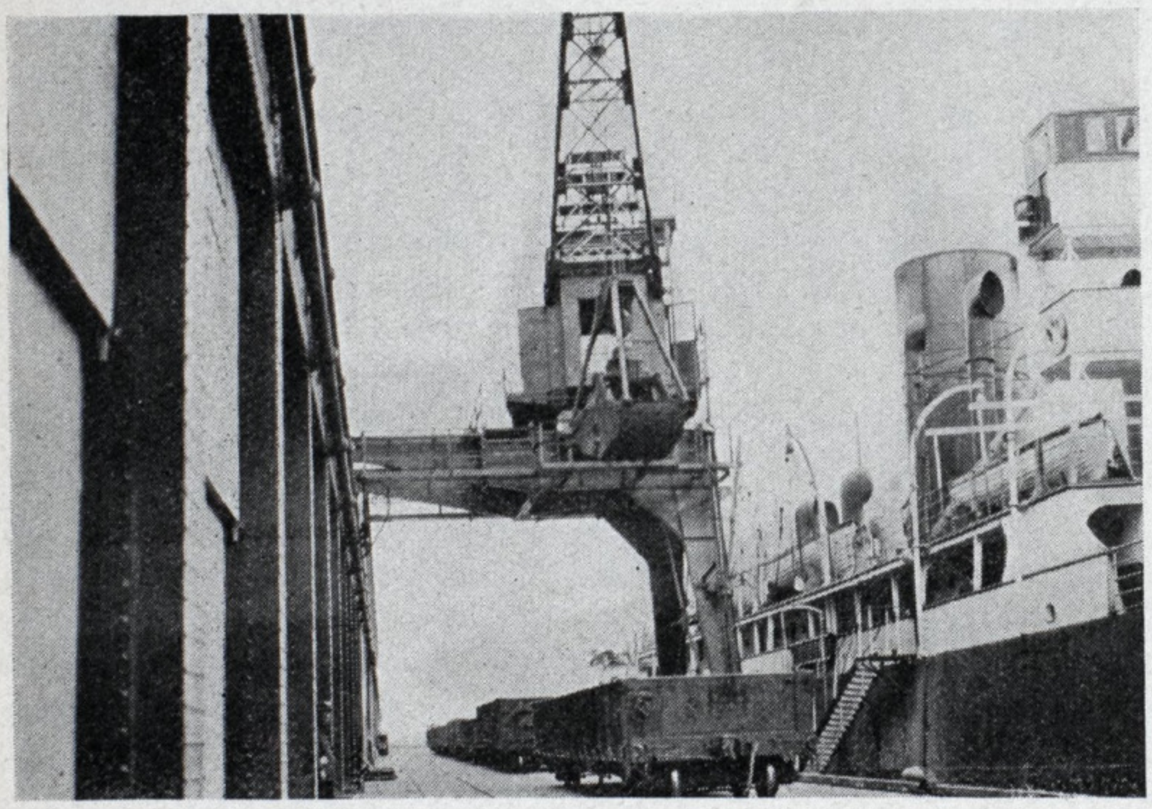


U. S. S. Procyon, New Training Ship, N. Y. Merchant Marine Academy-Renamed Empire State

Marine Terminal Design from the Operating Point of View

Part III*

ANOTHER moot question in terminal design is that of ship's tackle versus cranes. Although the ship's tackle is idle while ships are at sea, its use is basically economical due to lower operating charges because of presence of skilled men on shipboard for operation and maintenance. Further, ships tackle is always available to handle ships cargo, as without such tackle the ship might call at terminals having neither cranes nor cargo masts and deck winches. The tendency, in practice, is to place main reliance on the ship's tackle, often *supplemented* by cargo masts and winches at the transit shed. The latter combination, unquestionably, provides for rapid and economical handling of general cargoes.



Ten ton gantry crane on Western Maryland Railway Pier at Baltimore. Usedforspecialwork

Cranes have their place in the handling of special cargoes, in the loading and discharging of lighters or other craft not fitted with tackle, and sometimes as an auxiliary of ship's tackle to speed up operations. However, there is a tendency toward their infrequent use at American general cargo berths, and if they are installed, the numbers should be limited so as to provide for as nearly continuous usage of each unit as possible. Idle cranes are not alone an unnecessary capital charge but involve costly maintenance and expensive idle operators.

A rough comparison of relative costs between the burton system as against cranes shows that on a 900-foot length of pier side, cargo masts and 10 winches will cost approximately $50,000 whereas to accommodate the same length of pier side with cranes, 10 cranes would be required for 10 hatches. The cost of cranes and necessary runway is estimated at $160,000. This clearly shows that in order to make the crane investment profitable the cranes must be used continuously. From the terminal point of view, as a rule, cranes are not as economical as ships' tackle.

It might be stated further that American practice appears to be to place reliance on ships' tackle aided generally (on the Atlantic coast) by terminal cargo masts; with a recent tendency on the Pacific coast (which will, undoubtedly, grow) to utilize the same shore facility. European practice seems to favor the use of dock cranes. The decision as to which is the better does not involve simply an estimate of first-cost, maintenance cost and idle time of the shore facilities as compared with the ship facilities, but also must give weight to custom and experience and, perhaps, to *prejudice*, remembering that you can lead a horse to water but you can't make him drink. We favor ship's tackle with shore cargo masts and dock winches, and perhaps one or two cranes per berth for use in connection with barges and lighters and for special work or assisting ships gear.

Desirable provisions in terminal design, in accord with modern engineering and industrial practices, are those for the handling of cargoes in convenient units—kept intact as long as possible to avoid rehandlings, and kept on wheels, skids, or otherwise ready for movement at all times.

Floors, ramps, elevators, doors, and other structural features should be designed with the operations of trucks and trailers, portable cranes, lift trucks, skids, containers, etc., in view.

Further evidence of the lack of proper appreciation of the cargo handling features of terminals is found in the floors of terminals. The importance of good terminal floors is generally admitted but very often ignored. It is surprising the number of bad terminal floors found on marine terminals. When floors are good, ramps, aprons and gangways are often poor. A good floor may be defined as a floor which offers low starting and rolling resistance to the movement of a truck. From this standpoint an absolutely perfect trucking surface is a clean steel sheet. New concrete floors with hardened surface are about equal for all practical purposes. Steel sheets are not advocated for all floors but experience shows that their use may often be advisable for gangways where the major part of trucking is done. On the new Western Maryland marine terminal at Baltimore, steel gangways are provided alongside the depressed tracks that extend down the center of the piers. These gangways offer a perfect trucking surface for hand movement of trailers when making or breaking up trailer trains and also facilitates movement of trains by electric tractors.

Observation at various railroad and marine terminals indicates that the condition of ramps and gangplanks in general is poor. Ramps and gangplanks are usually constructed of wood and are usually badly worn. Checkered steel plates on gangways provide a better surface for hand truckers and give better traction to mechanical equipment.

A special kind of gangplank, used by the Eastern Steamship Co. at Boston is shown in one of the illustrations. This is used to drop trailers down the gangplank when the tide is

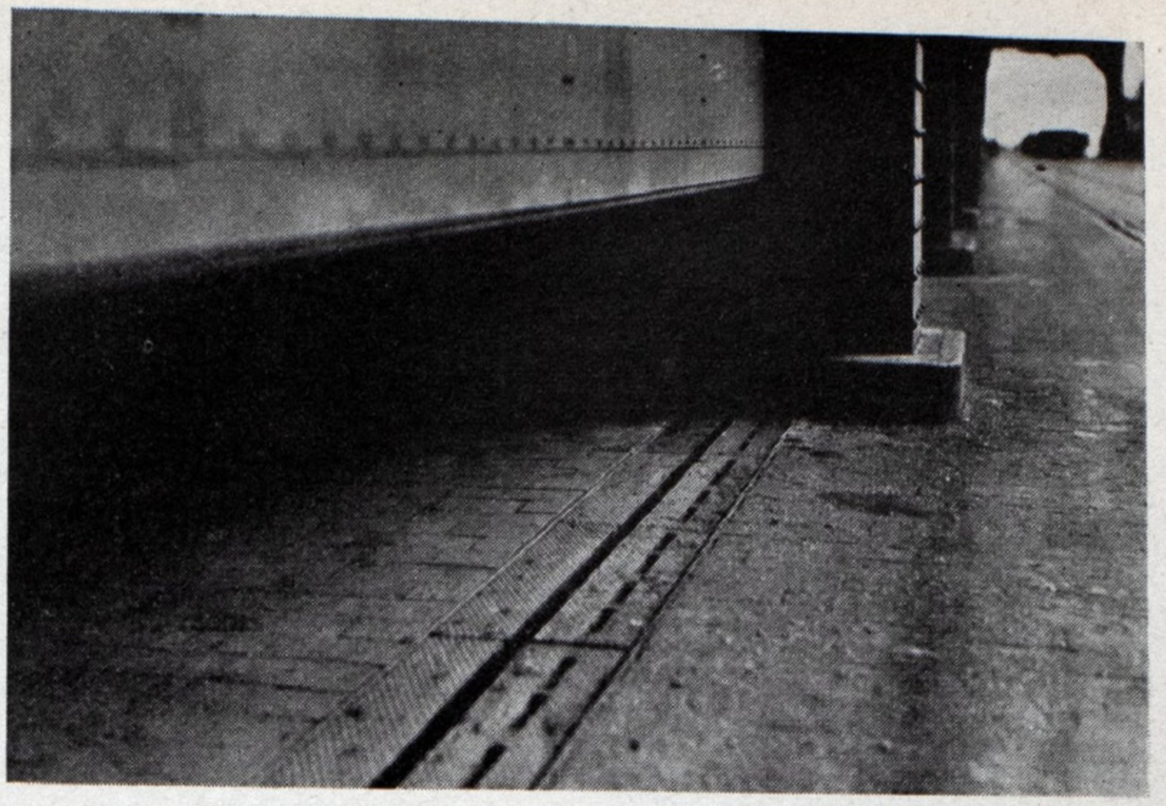
*This is the final instalment of a paper on *Marine Terminal Design from the Operating Point of View*, presented before the Society of Terminal Engineers at the Engineering Societies building, 29 West Thirty-ninth street, New York City, Feb. 9, 1931. The authors of this paper are: Frederic R. Harris, rear admiral, C. E. C. U. S. N. retired, consulting engineer; Harry E. Stocker, resident manager McCormick Steamship Co., New York, and contributing editor MARINE REVIEW; William B. Ferguson, consulting engineer; Roy F. Bessey, vice president, Frederic R. Harris Inc., consulting engineers. Published in three parts, the first and second parts appeared in the March and April issues of MARINE REVIEW.

low. A flexible side rail at the right is pushed against the side of the trailer by a large lever. In this manner the speed of the trailers is completely controlled regardless of the weight of the load. Trailers are brought out of the ship by an escalator. When power equipment is used in a terminal the electricity or gasoline consumed is so small that the effect of a poor floor is of small consequence. The chief disadvantage of poor floors on power equipment is the delay caused by stopping to pick up packages jarred off the trucks or trailers and the slower speed required to reduce this to the minimum. Often this results in a 50 per cent reduction in the speed. Money expended in providing good floors in new terminals or improving bad floors in terminals already constructed, is a wise investment.

The development of special cargo handling and transporting apparatus is more or less recent. It should be kept in mind that the future of this will be subject to considerable further development or variation, perhaps in directions which may not be at present foreseen and that terminals should be laid out with a view to their ready adaptation, if possible, to changing future use and requirements. This points to the desirability, in general marine terminal design and construction, of avoiding as far as possible, too much specialization in the design for handling equipment, remembering that a present tenant or user may in five or ten years, or more, be replaced by one requiring different facilities. In short, design of fixed structures should provide for adaptability and flexibility in use of equipment.

Shed doors are important from the cargo handling standpoint particularly as to their spacing, ease of opening and closing and protection afforded cargo from weather.

Doors should be provided along the whole length of the shed used for docking ships. This arrangement



Western Maryland Terminal Baltimore. Rectangular openings in deck in front of doors to drain off water. Lip on door fits into groove in pier deck

makes docking of ships with hatches in proper relation to doors comparatively easy and shortens the trucking distances in handling freight to and from ships, barges, and other craft. This is another application of the straight line production principle to shipping. Door spacing is especially important where aprons are narrow.

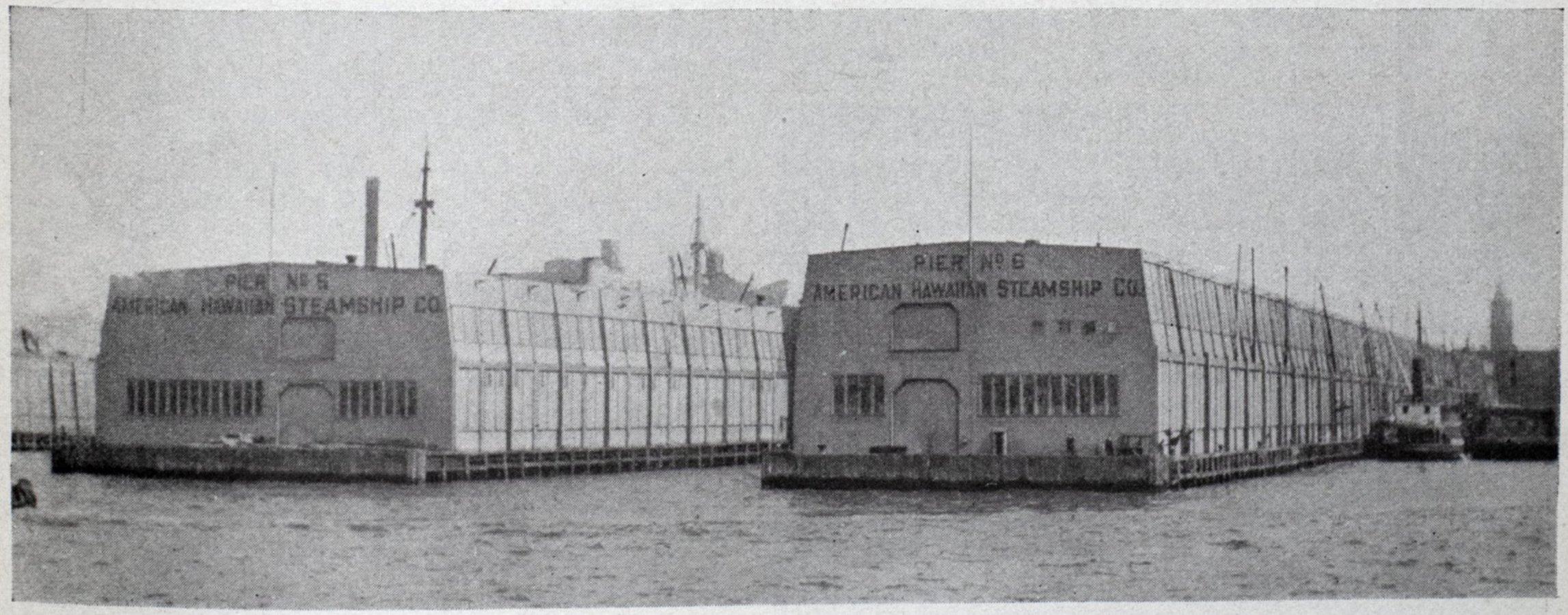
Doors should be durable and of type not interfering with cargo stowage in opening and closing, be easily operated, and should have at the floor proper provision to lead the water away from the interior.

Lighting is another important phase of terminal design. The subject of proper lighting of terminals and its importance from the standpoint of economical handling of cargo and safety cannot be over emphasized. Natural and artificial lighting is particularly important in reduction of personal injury risks as well as in the improvement of working efficiency.

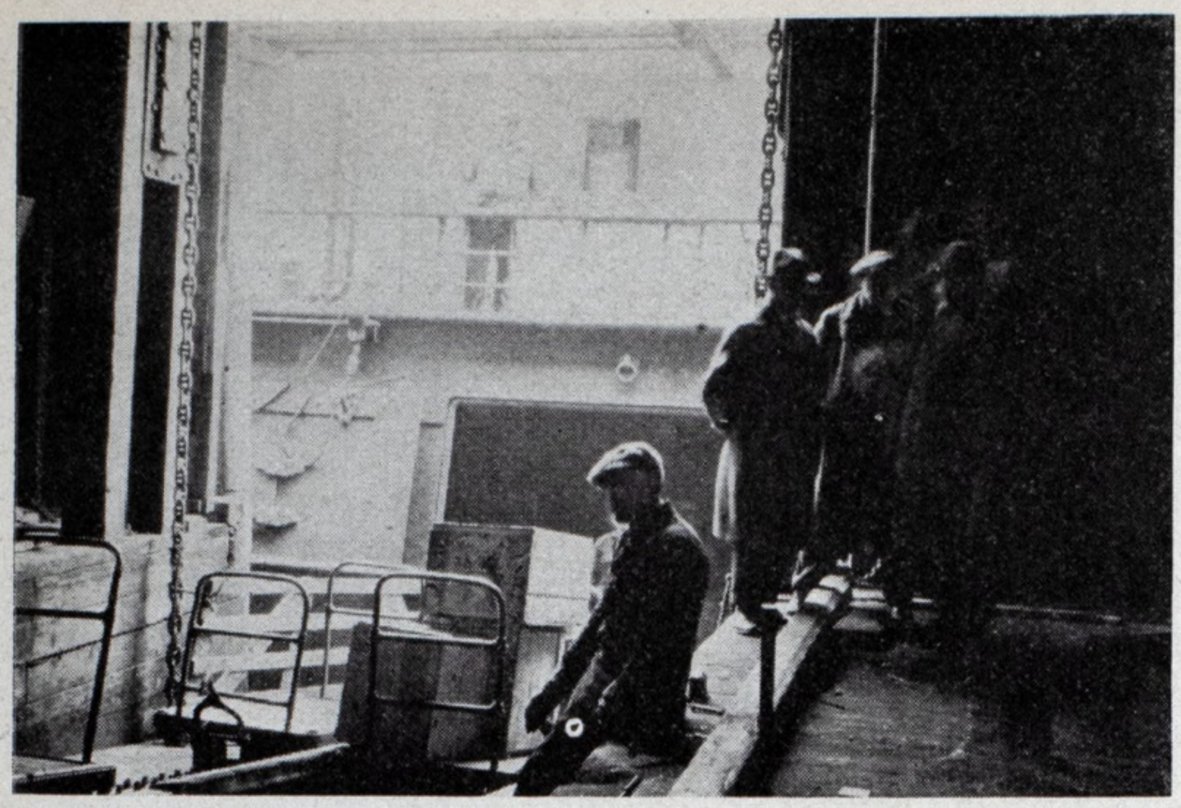
In the design of a terminal it is essential that proper facilities be provided for the personnel. In these facilities should be included toilets, rest rooms, etc. This should be done not alone from the standpoint of hygiene but because it is economical, saving much lost time of stevedores and other labor. It is also in accord with modern industrial practice.

The handling of bulk cargoes involves special problems and space does not permit going into details in this paper. Where bulk cargoes are voluminous and homogenous their handling affords the best opportunity for the application of modern engineering principles and the most economical transportation results. The transportation movements through the Great Lakes, in coal, ore and grain, are the best examples of this,—illustrating an almost ideal co-ordination of land and water transportation, terminal and handling facilities. Naturally, a similar degree of efficiency cannot be hoped for in the handling of complex general merchandise, but there is much room for improvement and bulk handling methods may point the way to some efficiencies in general cargo handling.

The unproductive port time of ships can, of course, be shortened principally by the efficient loading, discharging and handling of the cargoes. Other essentials for keeping port time at a minimum are the avoidance of use of unnecessary time in the servicing of ships with fuel,



Upper Deck Pier 6, Bush Terminal, Brooklyn, N. Y. is equipped with booms at doorway instead of cargo masts for assisting ship's gear. Electric pier winches are also provided. American-Hawaiian Line



Special type of gangplank used at Eastern Steamship Co.'s Terminal for handling cargo into and out of side port ships

water and other supplies. Provisions should be made for the bunkering of ships with fuel and for the flushing and filling of water tanks simultaneously with the cargo handling. In express liner service where the turnaround must be extremely rapid, and where considerable volumes of fuel and water are required, arrangements for these services must be especially carefully designed and checked. Telephone lines and shipside outlets for use of ships at berths provide a very desirable convenience.

Requirements for passengers at marine terminals are extremely variable. Nothing at all may be required at strictly freight terminals, while at express line terminals freight facilities may be secondary and provision may have to be made for handling several thousand passengers and visitors within a very short space of time.

For convenience and safety, it is necessary to separate passenger from freight traffic. Separate accommodations for passenger traffic may vary from small waiting rooms and overhead runways to ships sufficient for most coastwise wharves, to the separate pier deck, generally a necessity for overseas cabin and express line service. The segregation of traffic should, where practicable, be followed throughout, including that to and from the pier or wharf.

Details of the passenger facilities must of necessity be variable. Here again, dependence must be upon the best possible analysis of the prospective traffic, for the best design of waiting rooms, customs inpection facilities, connection with land transportation facilities, etc. The principles of routing as used in industrial engineering and management will also apply in the solution of this problem.

Provisions for the security of life and property are essential which must not be overlooked in terminal design and operation. Things to be looked out for are the safety of the vessel at its berth against collision, grounding, fire; provisions for easy berthing; adequate clearances; secure moorings; shelter against waves; etc.

Fire has always been a serious risk at piers and wharves, and untold wealth in terminals and ships has been lost. Much of this loss could have been avoided with proper precautions in terminal design and operation. While fireproof construction may not be practicable in many cases, it will nearly always be practicable to lessen greatly the risks through the installation of proper fire walls, screens and bulkheads, sprinkler and standpipe systems, watchman and alarm systems.

Again with fire: This resolves itself into a business problem of balancing insurance cost against the probable return on additional first-cost.

Terminal design should also provide for maximum safety against personal injury of workmen, passengers and others, through proper walkways, working spaces and conditions, gangways, material handling equipment, etc.

Proper safety provisions of all kinds, commensurate with those in up-to-date industrial practice, would be reflected in the stoppage of enormous economic losses in damages, personal and property, and insurance costs.

Reducing the time in port of a vessel carrying cargo, by improved designs of piers and ships, and by coordinating all the cargo handling features, is the most important money-making factor in the shipping business. This leads us to discuss *sea speed and port speed.*

Taking a concrete comparison for illustrating this point a 10,000 tons deadweight cargo vessel of 12 knots sea speed, 26-foot draft, single screw, costs about $1,500,000. and a corresponding 16 knot vessel costs $2,-300,000. over $800,000 more. The present tendency in design is toward faster ships, due partly to competition and largely to the increased number of voyages with a corresponding greater and more profitable volume of traffic per annum. For an assumed voyage of 14,000 sea miles, and using 40 days in port per voyage as the basis, we find upon calculating the economic results mathematically the following striking comparisons: The 16 knot vessel makes 4.70 voyages per annum, compared to 4.03 voyages per annum for the 12 knot vessel, increasing the revenues a corresponding amount, but also greatly increasing the operating expenses.

The same increase in the number of voyages per annum can be obtained by improving the port speed or days in port by 30 per cent—largely by improved designs of the cargo handling features of ship and terminal or pier,—at some additional first-cost, but nothing like the $800,000 greater capital expenditure for each faster ship and the same result. This speedier cargo handling, or 30 per cent improvement for the ships using the pier, which is often quite feasible, would increase the capacity per annum of the pier or terminal by 30 per cent and the increased revenues of the ship figures out about 20 per cent.

These sample figures demonstrate the tremendous economic value of speedy cargo handling, other things being equal, and the necessity of designing the marine terminal to permit the speedy release of the vessel.

We have not fixed definite rules and formulas for marine terminal design because this is not considered practical. Our chief objective is to stimulate discussion of terminal design from the operator's point of view to assist in improving design.

Tractor and train of trailers on a New York pier. Flooring laid lengthwise to traffic gives better trucking surface than when laid crossways as in this case

Food Costs on Ships Reduced By Using Proper Control

By J. Allan Masson

FOOD control is an important branch of the steamship commissary business the name of which exactly describes its function. Its aim is not only to account for the raw materials received from the purveyors, and for the finished portions that are served to the passengers and crew: it goes deeper into the heart of the business than that. Food control acts as a constant watchman during the processes by which these raw materials become finished menu items, and by its close contact at all times it serves the end of saving to the company the proper profit that usually is lost where food control is not present.

It should be noted particularly that food control effects its service by seeking out and showing up waste—not by attempting to cut down necessary expense or proper cost. There are many opportunities, even in galleys operated by sincere careful people to point out costly leaks that experience has shown can be corrected. Certainly food control attempts to dictate neither the quality of foods to be bought nor the size of portions to be served. Usually, indeed, knowing the importance of quality of materials in the value of the finished dish, and in the future growth of the client's business and contentment of the ship's personnel, the food controller will recommend that the best qualities only be purchased and that food portions be of a standard size. Any other recommendation would be unwise, for it would jeopardize the success of the line.

Food Costs on Various Ships

Experience shows that it is possible to save 10 to 15 cents in the food cost of each meal served on representative steamships, both on passenger and on freight ships. With food control in operation on passenger ships, the per meal food costs have been found to average between 22 cents and 32 cents, depending upon the class of the ship. On freighters carrying crews of 25 to 35 men the per meal food cost averages between 13 cents and 25 cents, with a general average cost of 20 cents per meal or 60 cents per man per day. Its cost of installation and operation has been found to be less than half the amount saved in food cost.

Food costs on freight ships, plying both inland and ocean waters, at first thought may not seem to need much consideration because the personnel on such ships is so much smaller than on passenger ships that the expense of feeding them appears small and rather an insignificant item in comparison. A cursory investigation, however, will show that it is an important item in the current expenses of any company operating a fleet of freighters, irrespective of the number in the fleet.

Many lines of freight ships do not maintain a commissary supply or general storehouse. All food items are purchased at various ports of call and the steward of each freighter, under the captain, is given authority to do the purchasing. Often the esteem in which he is held by the rest of the crew and his desire for such esteem is an index of such purchases being either within reason or excessive. Even in companies where a central commissary is maintained the outside port of call purchases may reach unusual proportions unless explicit instructions are issued and followed up as to the quality and quantity of food to be purchased at out-ports.

Careful Inspection of Articles

A steward frequently will hold the opinion that certain articles are of a much better grade when obtained elsewhere than when furnished by his home commissary. This may lead him to place an order so large that it will take more than one trip or voyage to consume the articles bought. In such instances the purchase prices are usually higher than those where the articles are supplied by the company.

A careful inspection of articles, especially perishable items, at time of delivery to the ship has a direct bearing on meal costs. If foods of inferior grade are delivered the steward should have full authority to reject them and call for better grades for replacement.

The handling of the stores on freighters too often receives but little consideration. Poor storage facilities are provided in many cases. Valuable food items are allowed to be thrown into any convenient corner and left there until such time as they are needed for use. Then, when they are needed, something has happened to them and of course the loss is charged up to meal cost. On the other hand, some companies have provided a separate storeroom and refrigerator for the crew's food supplies. The better the arrangements of this character are, the greater the saving in the cost of food consumed.

The preparation of food is important too; in fact it probably is the most important factor governing the cost of feeding. A poor cook can cost a company a great deal in dollars and cents. The quality of food supplied may be of the very best and yet if improperly prepared and not of a palatable nature, it is practically wasted.

Stewards also have it within their power to regulate their meal cost by careful and systematic methods in the quantities of food items used in the preparation of their meals. It is advisable to keep a steward on the same steamer as long as possible, for he soon becomes familiar with the appetites of the various crew members. In taking the raw food from storage a careful steward can save a company unnecessary expense by exercising care and judgment in quantities used.

Care and System Needed

It is not a difficult matter to control food costs per meal, in fact keep them almost at a uniform basis, if a food control system is in operation, and a reasonable amount of supervision is exercised by those officials having the commissary operations under their direction. Most assuredly it calls for a little extra work and supervision, but the results warrant the effort. A food control system, properly operated, places the direct control of all food operations directly in the hands of the fleet manager and enables him to prevent losses or stop leaks before they become serious.

Last year our company conducted commissary analyses on a number of freighters, owned and operated by various companies, both large and small. One of these companies maintained its own commissary; others specified certain stores with whom to trade in each port of call; others permitted the individual steward to exercise his own judgment.

As a result of these commissary analyses, it was found that the average food cost last season should not exceed 65 cents per person per day. As a result of installing and properly operating a simple food control system, many freighters operated on food costs amounting to less than 60 cents per person per day last year. This year, with more favorable market conditions, those freighters under food control supervision are expected to operate on a daily cost of about 54 cents per capita. The crews will receive the same amounts of the same quality of food as do the crews on other steamers. The lower per meal food costs will be secured by the food control system maintaining a positive control over food operations, thereby eliminating over-preparation, over-stocking, carelessness in operations, petty graft and other entirely needless losses.

Food control has been in operation in hotels, clubs and institutions for years. Less than two years ago it was first successfully installed and operated on passenger ships.

The author, J. Allan Masson, who has had experience on shipboard, is a member of the staff of R. M. Grinstead & Co. Inc., Commissary Analysists and Controllers.

Latest Data on New Marine Work

Information on New Ships Ordered—Building and Repair Contracts Let—Shipping Board Loans Made, Authorized or Pending

THE office of the chief of engineers, Washington, D. C. has advertised for bids for two steam driven side wheel river dredges for delivery at Cairo, Ill. These vessels will have a length molded of 260 feet, a length overall of 268 feet 11½ inches, a beam molded of 50 feet, a beam overall 84 feet 8⅜ inches, depth molded 8 feet 6 inches, and draft of 4 feet. They will be of the side wheel type, driven by steam propulsion engines. The hull and main deckhouse will be all steel construction and the upper deck and houses will be of wood. Boilers will be watertube. The dredging pump will be a 34-inch steam driven pump. Auxiliaries will be steam driven.

United States engineers office at St. Louis, Mo. will receive bids until 11 a.m. May 6 for constructing and delivering two steel hulls for quarter boats 152 feet long by 34 feet beam and 4 feet draft. The bids call for delivery at the United States engineer depot, St. Louis or Cairo harbor, Ill., or at bidders boat yard or landing which must be accessible to steamboats plying the Mississippi river and tributaries.

The United States engineers office at Vicksburg, Mass. opened bids April 28 for constructing and delivering afloat at Vicksburg, Miss. one 80-foot steel oil barge with a beam of 26 feet and depth of 6 feet.

Urges Faster Ships for South American Trade

At a luncheon of the Propeller Club, Port of New York, on April 16 C. H. C. Pearsall, vice president and general manager of the Colombian Steamship Co., gave a talk on the shipping, political and general business conditions in South America. He pointed out that one of the outstanding factors in the drive of European nations for South American trade is the construction of a fleet of fast modern liners and stated that if the United States wishes to hold its gains, additional government aid must be forthcoming so that American companies can build ships that will equal those of the foreign lines. Mr. Pearsall, who is regarded as an expert on South American shipping, recently returned from an extended trip to Colombia and neighboring countries. He believes that South America is the field to which the United States must look for future trade development.

"The United States purchases approximately $90,000,000 of Colombian products out of a total of $110,000,000, and sells to Colombia in a good year $40,000,000 out of $90,000,000," said Mr. Pearsall. "European nations are using every endeavor to increase their exports to South American countries and one of the most potent factors has been the recent construction of fine steamers through government subvention and aid to help in these trades. We hear on every side—'trade follows the flag,' but we must be ever alert to develop our ships so that they will be able to compete as to speed, service and accommodations in the particular trades in which they are operating; also it will be extremely difficult to hold for the American exporter and importer the trade which they so justly deserve."

Bids for Survey Boat

Bids have been received at the division engineers office, San Francisco Calif. for the construction of one 165-foot wooden hull, diesel engine driven survey boat. There were 11 bidders. Taking into account the bid and the time set for completion of the vessel, the bid of the Berg Shipbuilding Co. Seattle, Wash. was the lowest. The regular bid of this company was $35,907.60 and the time for delivery at Honolulu 115 days. This delivery time was 25 days less than that of the next lowest bidder, the value per calendar day of earlier delivery being specified at $10.00. Other companys to present bids for this work include the Mare Island Navy Yard, the Harbor Boatbuilding Co., Al Larson, Lake Washington Ship Yards, Tregoning Boat Co., Inter-Island Steam Navigation Co., George W. Kneass Co., Wm. Cryer & Son, Hines Bros., and the General Engineering & Drydock Co.

The three passenger liners building at the Fore River yard of the Bethlehem Shipbuilding Corp. for the Central American service of the United Mail Steamship Co. will be named ANTIGUA, QUIRIGUA and VERAGUA.

Plan Five New Liners

According to a report published in London in connection with the completion of the new 42,500-ton 24-knot liner EMPRESS OF BRITAIN, the construction of five new liners to cost about $10,000,000 each is planned by the Canadian Pacific line. So far there is no definite information regarding when orders for these additional vessels are likely to be placed.

Contract Is Awarded for Electrical Equipment

The contract for complete electrical equipment for the new diesel electric auto ferry SAN DIEGO under construction by the Moore Drydock Co., Oakland, Calif. was recently awarded to the Westinghouse Electric & Mfg. Co.

This vessel will have space for 50 automobiles on deck and accommodations for 200 passengers. The SAN DIEGO will be 304 feet long overall and will have a speed of 11 knots.

The electrical equipment includes three 225-kilowatt, 167-volt, direct current, single armature, shunt wound, 275 revolutions per minute, main generators which will supply power to two 500-volt, direct current, shunt wound, separately excited, propulsion motors, each developing 750 horsepower at 180 revolutions per minute. This equipment also includes three 30-kilowatt exciter generators which will furnish excitation for the main generators and propelling motors and power for auxiliary purposes. Complete switching and control equipment will also be included.

The total cost of this new ferry will be $392,330 of which $203,000 will be the cost of constructing the boat and the balance for the diesel engines and electrical equipment. The vessel will operate between San Diego and Coronado, Calif.

According to a report received April 9, the Cunard line will presently award a contract for another superliner costing about $30,000,000. The fact that her engines will develop 200,000 horsepower serves to substantiate the belief that she will have a speed in excess of 30 knots.

Two New Vessels Planned

According to reports from the Pacific coast, the Libera line is planning to add two new passenger and cargo vessels to its fleet of seven ships operating between the Pacific coast and Southern Europe. It is said that these new ships will have accommodations for over 180 passengers in all classes. They will have large space for refrigerated cargoes.

Board Opens Bids for Scrapping of Ships

The opening of bids received by the shipping board on April 14 for 10 laid-up ships to be sold for scrapping or conversion into barges revealed offers of more than 80 cents a ton on the scrapping basis. The Union Shipbuilding Co., Baltimore, with an offer of $53,293, was high bidder for the whole group, although offers of others for some of the vessels individually were higher.

The Schuylkill Transportation Co., Philadelphia, offered $10,000 for the LAKE GIRTH, a 4155-ton steel freighter, under a proposition to convert the vessel into a barge for use on the Delaware. In the case of three of the other vessels, the CONOTTON, 3630 tons, the EASTERN CHIEF, 6772 tons, and the PROVINCETOWN, 9469 tons, the Boston Iron & Metal Co., Baltimore, was high bidder with offers of $3012.90, $5620.76, and $7859.27, respectively. The total bid of the Boston Iron & Metal Co. amounted to $52,038.51.

The bids were taken under advisement by the merchant fleet corporation for analysis and recommendation for the shipping board.

Thirteenth Electric Vessel

The ninth electric tanker and the thirteenth diesel-electric vessel to be built for the Atlantic Refining Co. is now under construction by the Sun Shipbuilding Co., Chester, Pa. This vessel, to be completed late this summer, has the distinction also of being all-electrically welded in its hull construction.

Nine tankers and four tugs make up the total of 13 diesel-electric vessels owned by this company. Of this number, the electric equipment was supplied for eight (including the new one) by the General Electric Co., and for three more by the British Thomson-Houston Co., an affiliated company in Great Britain.

The power plant of the new tanker will consist of three Cooper-Bessemer diesel engines each driving a 105-kilowatt, direct-current generator, two with direct-connected auxiliary generators of 25 kilowatts capacity each. The main generators will deliver current at 125 volts and the auxiliary generators, at 120 volts. The propulsion motor will be rated 375 horsepower, 375 volts, 150 revolutions per minute, and will be a shunt-wound, direct current machine.

The usual variable-voltage control will be used with a station in the pilot house. The switchboard will be of the dead-front type. The auxiliaries and lighting equipment will also be electrified.

Diesel powered 41-foot boat built for public health service by Jakobson & Peterson, Inc., New York

Building Two Boats for Public Health Service

Two boats are being constructed at the yard of Jakobson & Peterson Inc., New York, for the public health service, foreign quarantine division, from plans prepared by P. W. Clark, naval architect. The boats were designed for semi-tropical service to be used as freight, passenger and general service work boats between the mainland and the quarantine stations. The dimensions of the boats are as follows:

Length overall....	41 feet	0 inches
Length on W.L.....	39 feet	9 inches
Beam molded	12 feet	0 inches
Draft loaded	4 feet	2 inches

The boats are powered with one four-cylinder, 6-inch bore by 6½ inch stroke, Fairbanks-Morse diesel engine.

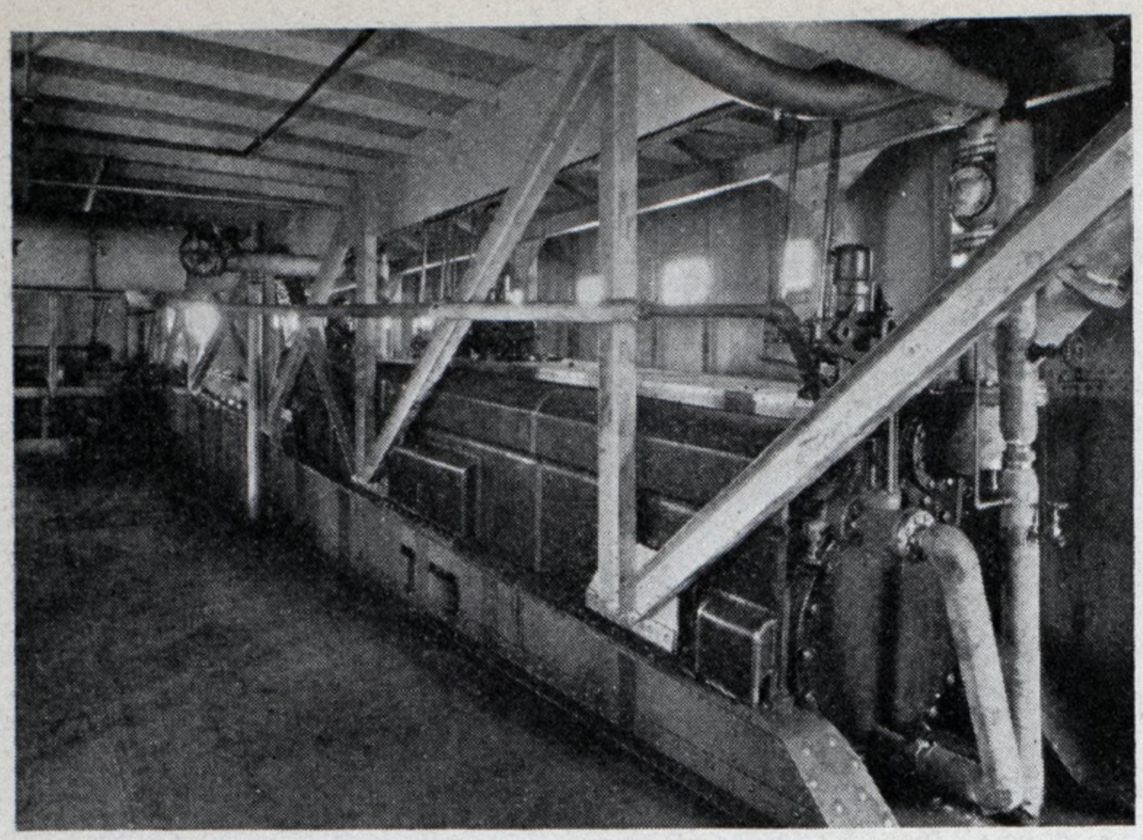
The forward portion of each vessel has a spacious deck for loading and transporting freight; and below there is a spacious cargo hold for carrying perishable materials. Ample ventilation is provided throughout by the installation of mushroom ventilators, airports and new lattice type doors which provide fresh air to all parts of the hull.

The design of the stern was adopted due to the rough nature of the work in which the vessels will be engaged. With the usual transom stern, maintenance costs are high because the corners sustain frequent impact. The circular transom is faired into the hull side planks so that there is a smooth round surface with practically no points of weakness against impact. This type of stern prevents settling and has a low resistance and fine run of water aft.

These vessels are both to be delivered under their own power about the middle of May.

Run Successful Trial Trip of New Motor Tanker

THE motor tanker GARONNE, built by Burmeister & Wain, Copenhagen, for Fearnley & Eger, Oslo, to the highest class of British Lloyds, is 425 feet long, 58 feet 6 inches beam, and 33 feet 3 inches draft. Two six-cylinder diesel engines with a total output of 4000 indicated horsepower are each coupled direct to separate propeller. On trials, with vessel fully loaded, the engines developed 4006 indicated horsepower at 146 revolutions per minute, giving a speed of 12.43 knots.



Port side unit of twin tandem compound condensing horizontal Nordberg engines installed in river towboats Patrick J. Hurley and James W. Good

Tandem Compound Engines in River Towboats

THE tow-boats PATRICK J. HURLEY and JAMES W. GOOD are equipped with twin tandem compound condensing horizontal engines built by the Nordberg Mfg. Co., Milwaukee. These engines are mounted on either side of the boat with the low pressure cylinders set forward and the high pressure cylinders aft. In size, the engines have 18 inches high pressure cylinders, 36 inches low pressure and a stroke of 9 feet. When operating at their normal speed of 18 revolutions per minute and with approximately 50 per cent cut-off, they develop 1000 horsepower. They are designed for a steam pressure of 300 pounds gage although the normal operating pressure is 275 pounds with 150 degrees superheat and a vacuum of 4 inches absolute.

Referring to the photograph which is of the port side engine, it will be seen that the cylinders are bolted to the engine beams at the center, thus allowing free expansion of the high and low pressure cylinders, the ends of which rest on free moving guides. The forward head of the high pressure cylinder is securely bolted to the aft head of the low pressure cylinder, thus forming a single unit free to expand, and one which is not affected by any weaving of the ship.

The steam and exhaust valves are of the Nordberg poppet type so long used on steam engines built by this company. They are mounted in removable cages and made of such materials that will permit the use of steam of high pressure.

The inlet valves on both high and low pressure cylinders are of the releasing type. They are operated by the Nordberg patented valve gear, the motion being a combination taken from the crosshead and pitman and thereby making the starboard and port side engines each independent.

The cut-off from zero to full stroke is correctly proportioned between the high and low pressure cylinders, thus securing high economy at all loads of the engines. Incorporated in the valve gear is a mechanism permitting the opening of all valves simultaneously, thus "putting the engine in irons." The reversing and valve lift mechanisms are operated by hydraulic thrust cylinders instead of the ordinary steam equipment commonly used.

A feature in the design of these engines is the reheating receivers placed between the high and low pressure cylinders. These receivers are located just above the cylinders and enclosed in sheet steel lagging. They contain coils through which steam at boiler pressure is passed, thus reheating the steam before it enters the low pressure cylinders. This not only improves the economy but assures of dry steam. The live steam, after passing through the coils of these receivers, reheats the forward low pressure cylinder head jacket and is then used for driving the boat auxiliaries. Since they take steam at a lower pressure than the propelling engines, the receivers act as de-superheaters, lowering the temperature of the steam to that suitable for these auxiliaries. At the end of the receiver is a reducing valve which lowers the pressure to that on which the auxiliaries operate. This steam for the auxiliaries is always available regardless of whether the propelling engines are running.

These engines drive a wheel of 23 feet diameter with a bucket length of 25 feet. The buckets are staggered, there being 16 with a width of 3 feet.

Launch Third Liner

The liner EXETER, third of a quartet of new combination passenger and freight vessels constructed by the New York Shipbuilding Co. for the Export line's express service between New York and Mediterranean ports, was launched from the Camden yards of the builders Saturday, April 14.

Run Performance Tests

The Sun Shipbuilding & Dry Dock Co.'s latest production, the diesel-engine propelled tanker SOUTHERN SUN, ran her performance tests recently in Upper Delaware Bay. Trial trip engineers and the ship's officers, upon the return of the huge bulk oil carrier to the Chester shipbuilding plant said the vessel's performances met all the contract requirements.

Each of the five vessels now being rebuilt for the Baltimore Mail Steamship Co. will be provided with the following Sperry equipment: MK. VIII Gyro-compass with duplicate motor generators, repeaters and course recorder, as well as a special repeater for use in the R.C.A. direction finder; two-unit gyro-pilot system giving complete control at will, directly to the steering engine; A-C rudder indicator system with indicators on the bridge and at emergency steering station aft; engine speed indicator system giving indications on the bridge as well as in the engine room; 18-inch pilot house type 1000 watt incandescent searchlight.

Bunker Prices

At New York

	Coal alongside per ton	Fuel oil alongside per barrel	Diesel engine oil alongside per gallon
April 18, 1931	4.85@5.25	1.10	4.32
Mar. 18	4.85@5.25	1.10	4.55½
Feb. 18	4.85@5.25	1.10	4.55½
Jan. 18	4.85@5.25	1.10	4.55½
Dec. 18	4.85@5.25	1.10	4.55½
Nov. 18	4.85@5.25	1.10	4.92
Oct. 18	4.85@5.25	1.10	4.92
Sept. 18	4.85@5.25	1.10	4.92
Aug. 18	4.85@5.25	1.20	4.92
July 18	4.75@5.00	1.20	4.92
June 18, 1930	5.00@5.25	1.15	4.92

At Philadelphia

	Coal trim in bunk per ton	Fuel oil alongside per barrel	Diesel engine oil alongside per gallon
Apr'l 18, 1931	4.85@5.25	1.00	4.60
Mar. 18	4.85@5.25	1.00	4.88
Feb. 18	4.85@5.25	1.00	4.88
Jan. 18	4.85@5.25	.85	4.88
Dec. 18	4.85@5.25	.95	4.88
Nov. 18	4.85@5.25	1.00	4.88
Oct. 18	4.85@5.25	1.05	4.88
Sept. 18	4.85@5.25	1.05	4.88
Aug. 18	4.85@5.25	1.05	4.88
July 18	4.75@4.50	1.10	4.88
June 18, 1930	5.00@5.25	1.20	4.88

Other Ports

Boston, coal, per ton	$7.36
Boston, oil, f. a. s., per barrel	1.26
Hampton Roads, coal, per ton, f.o.b., piers	$4.35 to 4.50
Jan. 8—Cardiff, coal, per ton	13s 6d
London, coal, per ton	—s -d
Antwerp, coal, per ton	19s 6d
Antwerp, Fuel oil, per ton	67s 6d
Antwerp, Diesel oil, per ton	82s 6d
British ports, Fuel oil	67s 6d
British ports, Diesel oil	82s 6d

Welded Channel Tank Tops, Side Tanks and Bulkheads

THE fifth and sixth bulk freight carriers on the Great Lakes have been reconstructed during the past winter under the welded channel system of construction. These vessels are the steamers MICHIGAN of 11,000 tons deadweight capacity, and the JOLIET of 10,000 tons deadweight capacity, owned by the Cleveland Cliffs Iron Co., of Cleveland. The steamer MICHIGAN is having installed a new welded channel tank top, and three welded staggered channel screen bulkheads. This work was done at the Huron docks by the Cleveland Stevedore Co. The steamer JOLIET is having installed new welded channel side tanks, and new intermediate side shell frames.

This vessel is of longitudinal construction, and as in the case of all lake ships of this construction where the spacing of the web frames has been twelve feet, it has been found desirable to install new 18-inch channel frames between the original web frames, from the turn of the bilge to the main deck, in order to strengthen the side shell of the vessel. The ship will therefore have a frame spacing on the side shell every six feet. This work is being done at the yard of the Interlake Engineering Co., Cleveland. These installations are based upon the performance of the previous channel installations, which were made in the steamers ISPHEMING and C. O. JENKINS during the winter 1929—30, and in the steamers GRAND ISLAND and COLONEL, during the winter of 1928—29.

It has been found in lake vessels that the side tanks receive nearly as much abuse as the tank tops, and in renewing side tanks heavier construction is used than originally. In the steamer JOLIET welded channel side tanks were not only installed to meet local abuse, but to give more longitudinal strength to the ship, as all channel strakes run for and aft, and for the full depth of the side tank.

Cargo hold or screen bulkheads as they are termed, have also received their share of abuse in past years, and new designs have been developed which eliminate all transverse stiffeners that were constantly being battered and broken down by clam shell unloaders. The latest design of cargo hold bulkheads, are of the staggered channel type, in which a combination of welding and riveting has been used. A picture of this type of bulkhead is shown on this page.

During the past eighteen months, more electric welding has been used in the steamers ISPHEMING, C. O. JENKINS, MICHIGAN and JOLIET, than in any other large American ships, either built or building, and the work has been satisfactory.

The design of this work and its supervision was carried out by W. G. Bartenfeld, vice president and manager of the Channel Steel Hull Corp., Cleveland.

Appoint Standing Committee Authorized by Conference

Chairman T. V. O'Connor, of the United States shipping board, on April 3 made the following announcement:

"The fourth national conference on the merchant marine, held in Washington last January, authorized the appointment of a standing committee, not less than five in number, to take such initial steps as might be necessary to carry into effect the resolutions adopted by the conference, to decide upon the merits of the recommendations contained in the various addresses, to follow up those that are deemed meritorious, and to make a report of its work to the next annual conference.

"It has been felt that this committee will have an unusual opportunity to perform constructive service for the American merchant marine, and considerable thought has therefore been given to the selection of its members in order that it will represent not only the more important interests comprising the shipping industry, but also the chief geographical sections of the country. The following named persons have signified their willingness to accept membership on the committee:

T. V. O'Connor, chairman United States shipping board; Ernest Lee Jahncke, assistant secretary of the navy; H. B. Walker, president, American Steamship Owners' association; H. Gerrish Smith, president national Council of American Shipbuilders; George A. Marr, vice president Lake Carriers' association; J. C. Rohlfs, president Pacific American Steamship association; Malcolm M. Stewart, chairman Middle West Foreign Trade committee; Joseph T. Lykes, president Lykes Brothers Co., Inc.; Robert C. Tuttle, manager, marine department, Atlantic Refining Co.

"Although the precise date has not yet been fixed, the first meeting of the above standing committee will be held in the near future.

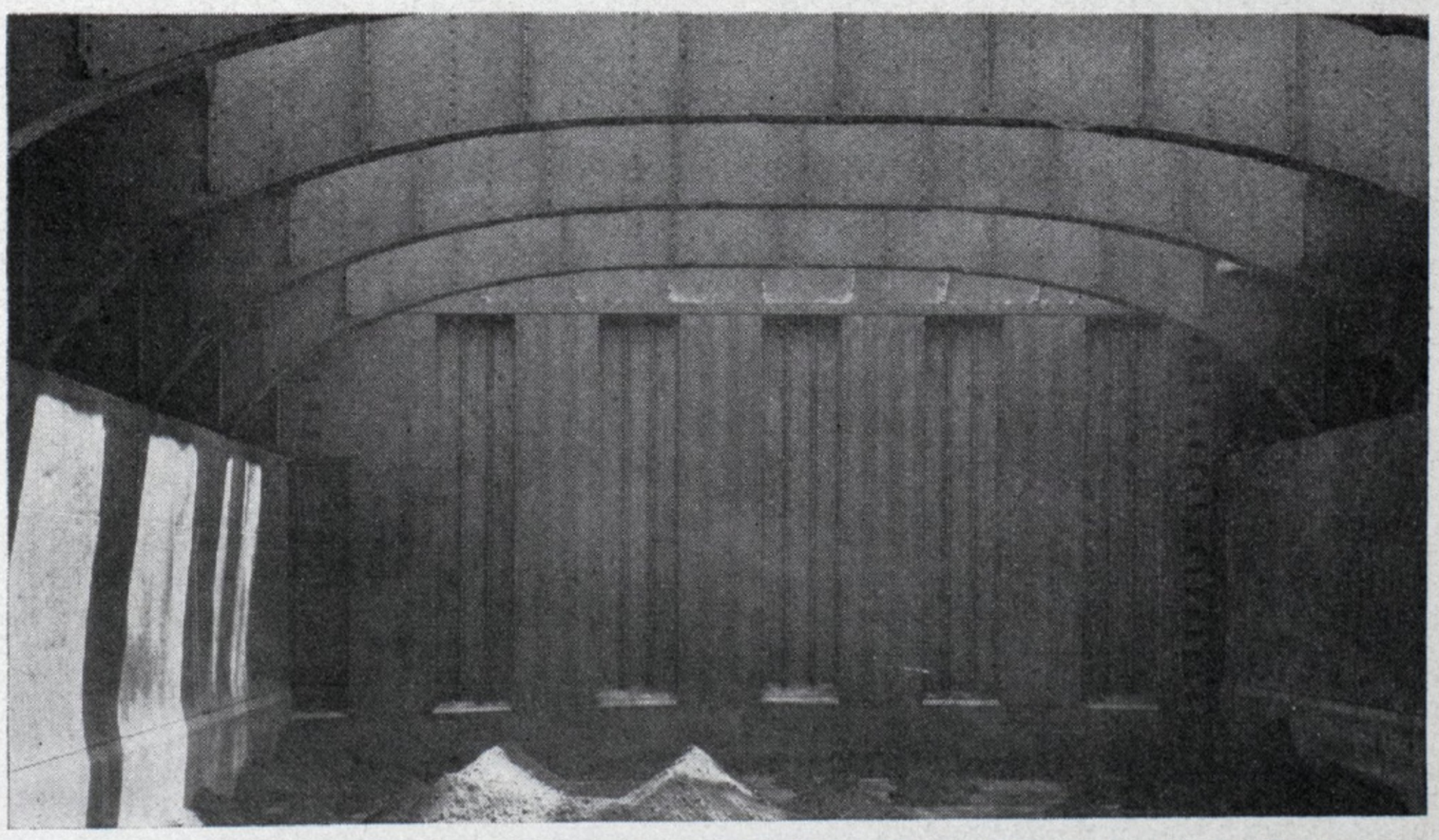
The shipping board's edition of the proceedings of the fourth national conference on the merchant marine is now available for distribution. Copies may be secured by addressing the United States shipping board, Washington.

Offer Consulting Service on Steel Castings

The Steel Founders' society recently established a Development Engineering department, headquarters 932 Graybar building, 420 Lexington avenue, New York, with a competent engineer and metallurgist in charge.

The principal function of this division will be to develop new uses or new applications for cast steel as well as to serve all industry in a consulting capacity with reference to metal construction problems, where cast steel is being or can be used.

This consulting service is offered without bias and at no charge to mechanical engineers, machine and equipment designers and others responsible for the specification of materials and their proper utilization in metal products of all sorts.



One of three staggered channel screen bulkheads installed in C. O. Jenkins

Late Decisions in Maritime Law

Legal Tips for Shipowners and Officers

Specially Compiled for Marine Review
By Harry Bowne Skillman
Attorney at Law

THE employment of a seaman includes not only the performance of the physical tasks required of him, but also includes the performance of such ordinary tasks for his own comfort and convenience as are incident to and necessarily connected with the employment. In performing such tasks, it was decided in the case of States Steamship Co. v. Berglann, 41 F. (2d) 456, a seaman assumes all of the ordinary risks of his employment, but, because he cannot quit the ship nor control the actions or orders of the ship's officers, he does not assume the risks of negligent acts of those in charge of the ship whereby his place of work as a seaman is made unsafe; nor does he assume the risk of failure of those in charge of the ship to take such precautions as the perils of the sea may render necessary and reasonable.

* * *

THERE is no question that seamen, though favored by the law and regarded as wards in admiralty, are capable of making releases for maritime injuries, yet in making such releases their rights are tenderly guarded and their acts, when waiving or yielding their rights, are carefully scrutinized.—W. J. McCahan Sugar Refining & Molasses Co. v. Stoffel, 41 F. (2d) 651.

* * *

BY VIRTUE of his office and the rules of maritime law, it is the master's duty to select and station his crew. The owner of a vessel who properly delegated to the master the duty of dividing watches on the vessel was not at fault for failure to interfere, unless violation of instructions was unknown. Where the owner has properly delegated duties with respect to the vessel's management to a competent person, something more is required in establishing knowledge and privity as to violations of statutes or regulations than mere negligence as to discovering whether or not those duties have been properly carried out; some degree of actual knowledge or participation must be brought home to the owners.—American-Hawaiian Steamship Co. v. Pacific Steamship Co., 41 F. (2d) 718.

* * *

UNDER our law, it was said in the case of ANDREE, 41 F. (2d) 812, a maritime lien which attaches to a ship will be preferentially recognized in the distribution of the funds resulting from recovery for the loss of a ship by collision or otherwise. It must be remembered, however, it was declared, that a maritime lien is merely a security for a maritime claim, and its real value to its possessor depends on the value of the res or its substitute when the lien comes to be foreclosed.

* * *

A MARITIME adventure is a multipartite relationship which is comparable, in a sense, to a partnership between the interests involved. The law of general average, when the contingency arises on which it can properly be invoked, is the partnership law of the adventure, and concerns itself, not with the claims for damage to the adventurer by outsiders, but wholly with the equitable adjustment, under its rules, of the rights and liabilities inter sese of the partners to the adventure. It governs the domestic relations of the adventure, and to import into it, for any purpose, claims against outsiders would be not only to distort it, but to involve it in such practical difficulties as would make the boldest adjuster tremble.—ANDREE, 41 F. (2d) 812.

* * *

A BILL of lading, drawn by a steamship company, must be construed most strongly against it.—Gelderman v. Dollar Steamship lines, Ltd., 41 F. (2d) 398.

* * *

A VESSEL lying in the open roadstead and delayed because of a wreck in the channel was held, in the case of BALDHILL, 42 F. (2d) 123, not to have "arrived" for loading at a port so as to start running of lay days. In considering what constitutes a port, the court quoted from the English case of Sailing Ship Carston Co. v. Hickie Co., 15 Q. B. D. 580, as follows: "The thing to consider is the 'commercial or business' port as distinguished from the 'legal' port. A port is a place intended for loading or unloading goods; hence includes the natural shelter surrounding water, as also sheltered water produced by artificial jetties, etc. If the area in question is a place of only comparative safety, the question is whether people in fact have their ships loaded or unloaded there; if they do, it is part of the port. To find out how much further out the port may extend, the question is whether the port authorities have assumed jurisdiction over vessels therein and the ships have submitted to port discipline."

* * *

AN OVERTAKING vessel, under article 24 of the *Pilot Rules*, is bound to keep out of the way of the overtaken vessel, and when the latter accedes to a passing signal, she assumes no responsibility for the overtaking vessel's maneuver, and is under no obligation except to refrain from interference with the overtaking vessel and to hold her course and speed as far as practicable.—CEDARHURST, 42 F. (2d) 139.

* * *

THE owner has the burden of proving that his barge was seaworthy when the cargo was loaded, it was declared in the case of HARPER No. 145, 42 F. (2d) 161. It was also said that the leaking and capsizing of the barge raised a presumption of unseaworthiness, but this presumption might of course be rebutted.

* * *

IN CONSIDERING section 450 of the United States code, making any vessel liable when "used or employed" in discharging refuse, slush, etc., in the case of COLOMBO, 42 F. (2d) 211, the court said: "The statute speaks with the maritime law in mind, under which the ship is so often regarded as an offender. This is indeed a fiction, but its roots go back far into the law, and the resulting liability is like many others imposed upon an individual, regardless of his personal fault. Having committed his ship to the seas, an owner takes the risk of much which he cannot easily control. As between him and the injured party, it is thought desirable to throw the loss where prevention would have been at least possible."

* * *

THE test of navigability in fact of a stream or lake is whether in its natural condition it is used or susceptible of being used in its natural and ordinary condition as a highway for commerce over which trade and travel are or may be conducted in the customary modes of trade and travel on water. To meet that test a water course should be susceptible of use for such purposes. It should be of practicable usefulness to the public as a public highway in its natural state, and without the aid of artificial means. It must have had a useful capacity long enough to be used as a highway of transportation, and such purposes, use, and navigability must be established by clear evidence.—United States v. Ladley, 42 F. (2d) 474.

* * *

THE right to limitation of liability applies to a claim founded upon a nonmaritime or a maritime tort if it arises out of the carelessness or conduct of the master and crew, it was held in the case of ATLAS No. 7, 42 F. (2d) 480, but leaves the owner liable for his own fault, neglect, or contract.

Marine Business Statistics Condensed

Record of Traffic at Principal American Ports for Past Year

New York

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	494	2,396,654	489	2,323,422
February	439	2,127,771	484	2,261,468
January	486	2,417,338	542	2,533,711
December	539	2,497,454	521	2,454,917
November	485	2,194,780	470	2,144,883
October	530	2,546,629	548	2,636,414
September	591	2,877,309	556	2,693,493
August	554	2,716,668	586	2,855,323
July	578	2,717,787	616	2,815,336
June, 1930	585	2,722,344	559	2,596,692

Philadelphia

(Including Chester, Wilmington and the whole Philadelphia port district)
(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	65	198,848	46	116,786
February	69	200,212	53	163,134
January	70	227,146	49	158,570
December	80	206,778	55	144,471
November	87	226,006	46	122,107
October	85	231,460	53	144,530
September	87	232,781	52	147,365
August	92	244,206	55	144,201
July	96	246,866	68	151,861
June, 1930	92	240,323	72	169,627

Boston

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	97	279,797	66	243,377
February	76	259,402	57	190,598
January	76	245,382	49	195,091
December	91	287,347	50	174,971
November	77	248,220	61	232,826
October	96	321,092	65	208,695
August	115	305,649	101	299,454
July	152	325,325	110	222,555
June, 1930	152	325,325	110	222,555

Portland, Me.

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	6	20,081	7	20,122
February	18	48,722	15	45,664
January	.....	.....	.....	.....
December	23	55,605	23	60,126
November	21	46,182	20	40,916
October	17	41,667	20	45,989
September	32	53,423	28	49,428
August	36	69,765	36	72,282
July	42	83,987	42	84,939
June, 1930	39	70,119	34	60,536

Providence

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	5	18,288	4	17,400
February	9	43,707	8	30,036
January	8	28,019	5	15,335
December	9	36,380	6	25,318
November	13	46,927	5	18,597
October	10	37,269	5	22,305
September	6	28,972	3	16,265
August	7	29,532	4	16,388
July	10	36,403	5	19,623
June, 1930	6	26,588	4	18,640

Portland, Oreg.

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	41	158,869	46	173,220
February	24	95,726	43	175,697
January	29	119,686	47	192,455
December	27	107,300	52	197,628
November	30	122,020	53	208,266
October	40	155,991	54	207,118
September	30	122,022	46	182,641
August	32	125,137	46	174,985
July	30	118,919	53	193,425
June, 1930	31	122,569	48	175,167

Baltimore

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	123	385,514	107	336,157
February	99	327,516	106	340,771
January	121	386,924	127	412,306
December	120	390,126	127	429,048
November	116	384,877	117	376,725
October	139	452,905	127	402,155
September	150	475,928	138	424,976
August	130	412,209	125	396,421
July	132	444,823	144	455,226
June, 1930	153	486,645	157	481,837

Norfolk and Newport News

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	19	47,982	52	137,616
February	15	43,123	46	116,116
January	21	57,883	61	170,594
December	44	92,341	63	174,384
November	22	65,716	56	141,242
October	21	72,517	58	153,410
September	21	48,971	66	168,922
August	28	66,765	50	139,710
July	27	63,721	60	144,446
June, 1930	23	52,701	43	109,274

Jacksonville

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	10	17,299	6	7,839
February	7	18,934	9	20,915
January	14	28,243	10	15,617
December	17	33,862	16	29,847
November	14	30,105	10	13,048
October	14	27,810	14	27,016
September	12	26,442	13	26,356
August	15	29,565	12	20,856
July	6	14,312	8	20,739
June, 1930	10	25,129	12	23,737

Key West

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	60	69,731	56	72,956
February	61	70,169	56	69,443
January	61	82,218	57	30,394
December	.....	.....	.....	.....
November	49	63,307	50	64,389
October	50	61,288	49	60,432
September	48	64,968	48	64,742
August	50	61,440	50	61,666
July	56	68,968	55	69,397
June, 1930	57	69,679	56	68,653

Mobile

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	.....	.....	.....	.....
February	93	222,163	86	206,376
January	.....	.....	.....	.....
December	91	208,802	84	194,477
November	106	241,663	99	220,755
October	99	187,035	92	196,893
September	83	184,276	81	171,679
August	102	190,362	96	176,488
July	113	211,989	95	173,549
June, 1930	113	211,446	111	212,639

Seattle

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	47	207,105	49	212,237
February	48	212,187	53	233,121
January	54	238,037	60	266,744
December	56	240,203	61	256,724
November	59	255,728	57	245,592
October	57	246,957	63	272,114
September	62	268,203	58	250,301
August	48	200,602	48	209,109
July	54	248,954	60	261,746
June, 1930	49	215,525	53	228,554

New Orleans

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	.....	.....	.....	.....
February	159	499,643	172	537,813
January	207	610,472	190	548,267
December	203	602,527	197	578,723
November	187	555,053	194	541,671
October	218	633,652	228	672,782
September	210	589,459	218	605,239
August	220	600,786	241	666,625
July	270	697,526	245	653,562
June, 1930	233	606,340	239	626,307

Charleston

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net. tonnage	—Clearances— No. ships	Net tonnage
March, 1931	.....	.....	.....	.....
February	.....	.....	.....	.....
January	.....	.....	.....	.....
December	.....	.....	.....	.....
November	.....	.....	.....	.....
October	.....	.....	.....	.....
September	19	54,863	19	69,530
August	13	34,274	13	24,742
July	25	70,538	25	51,805
June, 1930	18	42,196	18	46,140

Galveston

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	25	39,536	69	205,341
February	23	40,825	71	209,057
January	25	45,442	84	260,555
December	.....	.....	.....	.....
November	.....	.....	.....	.....
October	.....	.....	.....	.....
September	46	117,185	119	337,091
August	37	82,429	97	277,077
July	40	93,999	83	249,064
June, 1930	28	60,622	63	171,223

Los Angeles

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	.....	.....	.....	.....
February	181	557,981	196	561,570
January	191	673,620	193	753,720
December	227	654,598	184	596,347
November	219	618,855	206	616,266
October	236	680,430	217	628,733
September	255	697,262	218	616,018
August	211	631,167	221	621,088
July, 1930	230	687,670	196	611,768

San Francisco

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	.....	.....	.....	.....
February	.....	.....	.....	.....
January	165	685,851	172	721,042
December	154	646,767	174	689,358
November	144	570,715	161	656,424
October	151	617,143	154	639,552
September	171	699,832	154	629,577
August	164	670,748	159	653,208
July	166	674,380	166	676,092
June, 1930	154	652,411	134	560,605

Houston

(Exclusive of Domestic)

Month	—Entrances— No. ships	Net tonnage	—Clearances— No. ships	Net tonnage
March, 1931	24	106,838	32	131,470
February	30	130,544	38	152,347
January	26	111,047	37	140,860
December	35	143,585	47	185,757
November	28	105,541	50	178,538
October	34	136,215	50	182,729
September	32	140,415	62	220,024
August	39	147,462	69	257,365
July	30	120,727	42	158,570
June, 1930	47	190,145	45	193,620

Note: The figures given in this table are for direct entrances and clearances. Additional vessels in foreign trade enter and clear from and to other American ports after original entry and before final departure. At the port of Philadelphia, for instance, additional vessels in the foreign trade in this category were 71 of 244,007 net tons entered and 78 of 267,434 net tons cleared for the month of March.

Modern Stevedoring and Dock Management

Practical Ways to Cut Costs in Cargo Handling

Conducted by
H. E. STOCKER

Care and Operation of Electric Cargo Winches an Aid to Efficiency

By Frank V. Smith

CARGO winches are about the most important pieces of apparatus on a ship in port. They can be either a source of pride or a source of worry, depending upon the caretaker. Because of location on an open deck, occasional submergence by seas, operation in weather ranging from a blistering sun to a blizzard, they have to be built to stand a lot of punishment. Apparatus that cannot withstand the elements has no place on a ship.

Cargo winches are operated by stevedores of all nationalities, all creeds and all colors. Printed instructions, oral instructions, or brass signs are of little use. Their operation must both be simple and obvious. From this, it looks like the manufacturer has taken quite a little responsibility on his hands, and so he has. When he took a chance on the elements, or depended upon operating instructions being given to the stevedores, everything went wrong. Control finger tips were burned, fuses were blown, and resistors melted. Anyone of these items can put a cargo winch out of commission temporarily, and there is nothing quite as useless as a cargo winch that will not work.

The history of cargo winch electrification is short but exciting. The reading of the early records is an education in itself. The turning point came when the manufacturers ceased trying to do the impossible and set up a bogie based on actual ship conditions. The ideal condition set up for the designers to meet read about as follows:

Motors—To be of totally enclosed type, to resist the entrance of water even if submerged for short intervals, and self-draining of water that might seep along the shaft, or of condensate caused by temperature changes. All fittings to be noncorrodible and to withstand damp salt air. Insulation to be nonhydroscopic. Frame to be heavy and rugged to withstand seas. Lubrication to be effective when motors are operated at a tilt.

Operating Stand—One lever operation; to operate easily so as not to tire the operator, and situated at a convenient height—the height of a man's elbow. Operating stand to be small and rugged, and not to obstruct view of either the hatch or side of vessel. Operation of control lever: Upright position "Off"; forward movement, "Hoist"; backward movement, "Lower." Speeds to be gradually higher as lever is moved from central position. Graduated, automatic acceleration or retardation of load, irrespective of the speed with which the stevedore may move the lever.

Braking—Brakes to automatically set when the control lever is moved to the "Off" position and also in case of any line disturbance, or cessation of power supply. Retardation of load to be accomplished by dynamic braking and shoe type of brake to come into play as a holding brake only in order to save brake linings wear and tear and eliminate renewals.

Control Panel—Solenoid actuated contractors with arc chutes, and of sufficient capacity to give continuous service over long periods of time without renewals. Under-voltage and over-voltage protection, and automatic relays to provide smooth rapid acceleration without jerk or high peak currents. Overload circuit breaker to be reset when controller handle on operating stand is moved to "Off" position.

In summing up the advantages of the ideal system, it will be noted that the stevedore has been relieved of all responsibility and it presupposes only enough knowledge on his part to push or pull a small lever in the direction he wishes the load to travel. He is even relieved of the responsibility of working a foot brake. Before the days of automatic control, the stevedore was supposed to move the control handle slowly so as not to cut out all of the line risistance before the motor had a chance to accelerate. In an American port this might be accomplished in a measure by proper instructions, but when a ship arrived in some foreign port with all of the language difficulties, it was not easy. When stevedores were told to move the control handle slowly, they generally jerked it over all the faster, with the result that fuses were blown and finger tips welded. Too much persuasion even led to strikes, with the result that ships were delayed. Spare parts were ordered by the gross—a good business for the electrical manufacturer, but a poor advertisement for electric cargo winches.

During the transition period, between the use of manual control and

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The author, Frank V. Smith, is a member of the staff of the Federal and Marine Department of the General Electric Co.

automatic control, the designers attempted to meet the situation by installing control levers that worked as if intended to move a ton weight. This only tired out the stevedore, made it almost impossible for him to "inch" a load, gave him a sore arm, and slowed up operations.

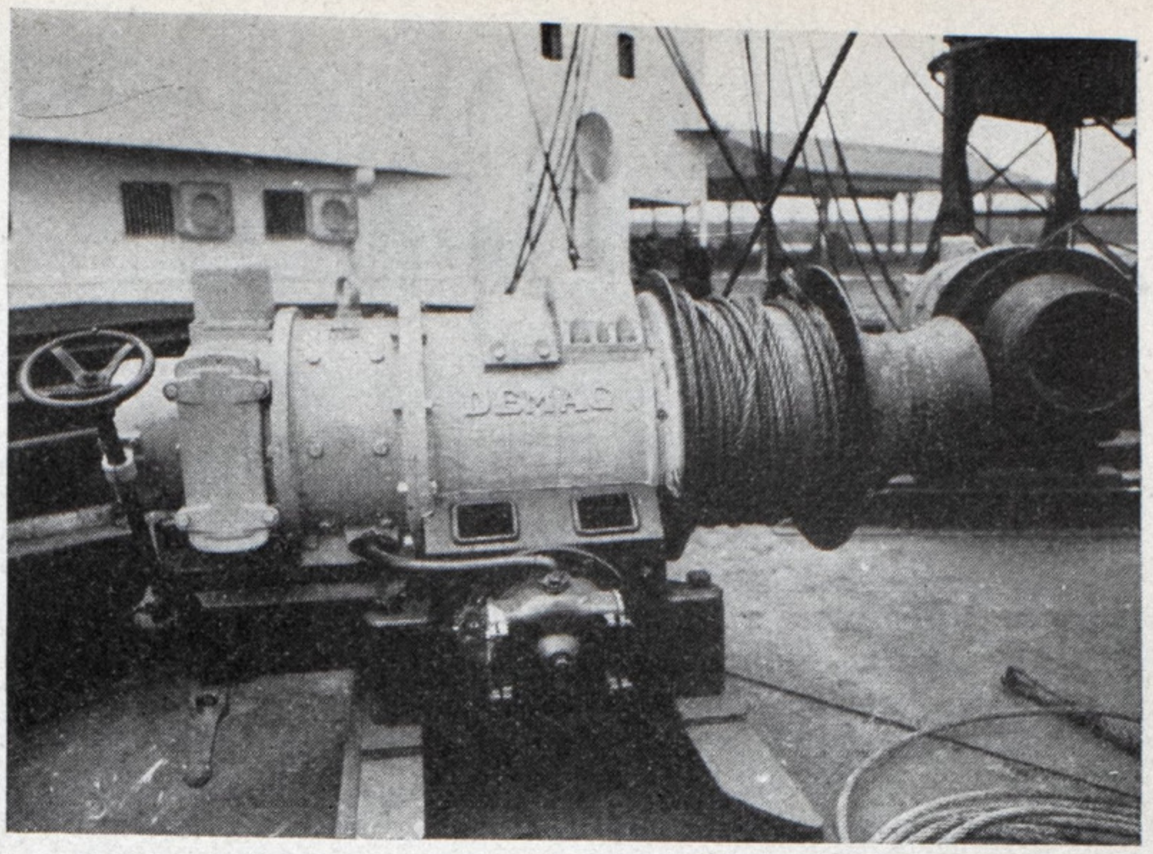
All of these troubles are now in the background and can be charged to experience. Today when a cargo winch with automatic control is installed, that is generally the last the manufacturer hears of it. There are but few orders for spare parts and the complaint files are as bare as the proverbial "Mother Hubbard's cupboard."

Now this brings us to the point of what kind of instructions are to be given in the operation, care and upkeep of electric cargo winch equipment.

From the standpoint of operation there is not much to be said. Let the stevedore push or pull the control handle fast or slow, as he likes. There is only one way he can get into trouble and that is to reverse the cable on the drum. When the equipment is installed, the line is supposed to feed out over the top of the drum. When the cable is reversed, then, of course, the hoisting is done on the electrical connections intended for lowering and the lowering on the hoisting connections. The effect of dynamic braking is lost, and the power available for hoisting is only that small amount intended to start the motor in the reverse direction when lowering. This imposes a heavy current load which is dissipated in the resistors, and if continued, is likely to burn out a block of resistors. This has happened but, of course, is very rare. It is a good thing then to have someone on the ship's force look around occasionally to see that no-one has played this "dumb-bell" trick.

Care and upkeep is something different from operation. It is what the engineering personnel are responsible for. Common sense is the main requisite required. Troubles usually occur because of tinkerers or ones who do things without any reference to what is required.

It seems strange that a little thing like an oil-can in the hands of an over zealous engineer can cause a lot of woe but this is true. Every motor, of course, must be lubricated and there is an oil well on both ends of the motor shaft for this purpose. These oil wells are supposed to be filled up to a certain level and a filler pipe with plug is provided for this purpose. When oil is put in through the filler pipe the level of the pipe is such that the well cannot be flooded. On top of the bearing housing there is also located a handhole plate, placed there for purposes of holding up the oil ring when assembling the motor. Some bright oilers have found that by removing the handhole plate and oiling through there, that they could flood the oil wells and fill the inside of the motor as well. In some cases they have not been satisfied until the oil has covered the commutator, the brushes, and windings, and run all over the deck through the drainage check valve. If there is anyone who can make a mess out of a motor quicker than an oiler who prefers to oil through hand hole plates, the author would like to get a snapshot of him.



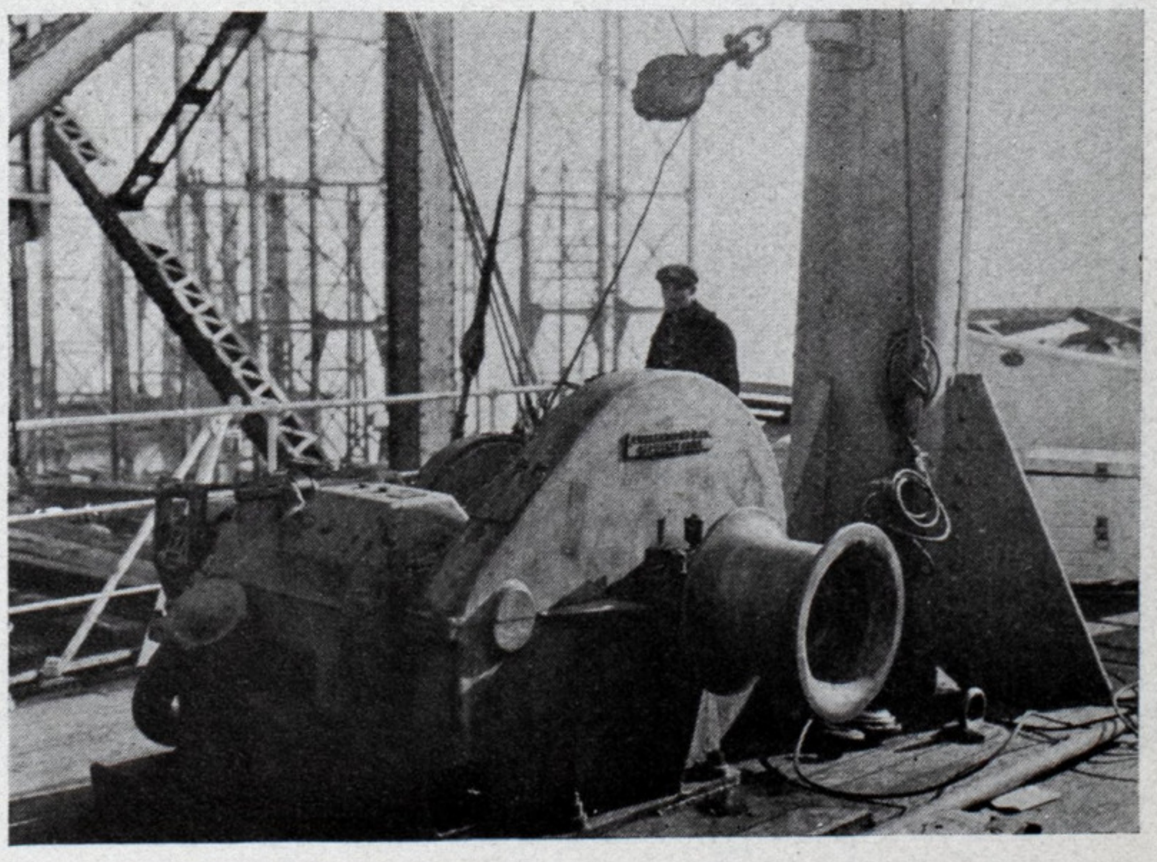
New type of German electric cargo winch. All mechanical and electrical parts including the controls are combined in the winch block. Braking is automatic when current is turned off. Can be operated by untrained hand

Aside from the cargo winches, there have been cases where grease has been forced into ball bearing motors until the accumulations on the decks and in the motor are sufficient to supply the needs for 30 years. Ball bearing motors require looking at about once every three months. The ball races are to be about one-third filled, and the old grease cleaned out and renewed about once a year, and still there are oilers who persist in crowding in grease every watch.

Motors on deck naturally must permit water to escape but not to enter. A drain with a ball float is provided for this purpose. At one time this check valve was placed rather low in the frame and it was possible with some gymnastics on the part of the painter for him to reach underneath the frame with his brush and paint the bottom of the ball and the seat of the check valve. It was such a common occurrence to have these drain valves so plastered with paint and inoperative, the designers were forced to move them inboard out of reach of the brush. If the painters put an extension on the handles of their brushes, or start using a spray gun, the designing engineers have got another job ahead of them.

For some reason, the automatic control panels have not given any trouble. This is probably due to the equipment being installed in a deckhouse and under a lock and key, which keeps the painters and oilers out. The requisites are cleanliness and tight connections. The room where the panels and resistors are located is a poor place for the crew to stow discarded clothes.

Electric motors and automatic control for cargo winch duty are designed to stand hard operating usage. Series motors, the type generally used, have rugged characteristics. The heavier the load imposed on them, the harder they pull. They are the bulldogs of the motor kingdom. With proper lubrication, check valves free of incrustations of paint, and the line reeled the right way on the drum, they will outlive the ship on which they are placed. They buck, however, when oiled through the handhole plates.



Electric cargo winch on the American Motorship East Indian. 25 horsepower 310 revolutions 230 volt marine type—brake of watertight solenoid type

Material Handling Methods Applied in Industry

By F. L. St. John

THE successful modern plant meets the high cost of labor and materials by more effective use of machinery and power increasing output per man and decreasing cost per unit, making the best possible use of the working hours in a day.

The movements of materials in many plants is done by unskilled help Perhaps this same unskilled help may be operating trucks, vehicles and really good modern handling equipment, perhaps the plant has been carefully laid out to expedite material movements, but until the subject of material movement has been given the same careful study as the actual production, there are possibilities of enormous waste. It has been estimated by statisticians that the average methods of material handling in American industries waste more than three billion dollars a year in out of date material handling methods. This figure is based on the savings accomplished by the few plants which have modernized their methods as compared with the average total volume of goods manufactured throughout the country.

Accurate costs should be kept of performance, operation and maintenance costs, overhead charges, variable and fixed, as well as statistical, which can be simplified and carried on one sheet for each power unit operated for each month and recaped for the year. A reduction in expense can be made almost daily rather than waiting until the monthly figures are available which, in a large plant, means hundreds of dollars loss. The figures also act as a governor on any slack in the line as the daily record will show the tonnage handled and the cost per ton, which the operating head should have every day. With this he can stop any leaks promptly. This plan will operate equally as well if used in a plant or in a transportation company.

A good system is to put the handling of materials on a piece work basis. This operates well in several ways. It keeps the operator on his toes, prevents carelessness in handling, loss from breakage, etc. For if the materials are not delivered promptly and in good order, it is up to the operators to put them in good order, and he will be more careful with the equipment, knowing that if it breaks down or cannot be operated efficiently, it cuts down his earnings. The result is a personal interest on the part of the operator in keeping his equipment in the best possible shape and the reporting of any delays in movement which in any way slow up the operation.

This plan has been worked out in several large plants very successfully and has resulted in large savings, both in cost of handling and damage to materials. It eliminates loafing and aids in selection of equipment for proper handling of the job on hand. This puts the men on a friendly and competitive basis, prevents overloading and overspeeding, for any mishandling is checked against his time and earnings.

Maintenance costs have been greatly reduced where careful inspection has been maintained. One large plant in normal times, operating 150 power units have a weekly inspection and find that it pays. Any parts requiring attention are properly tagged and the machines are sent to the repair department where the work is done. Labor and parts (if necessary) are charged on the work card. The mechanic signs his name and certifies as to the time spent on the job, and in turn, the foreman removes the tag, signs his name, returns the machine to the operating department and the tag to the office where the superintendent approves the charges and passes it on to the bookkeeper to enter against the cost of operating the unit.

Practically every plant has its own problems. No two are exactly alike yet the underlying principle of prompt movement of materials at a minimum cost is the objective in every case.

Performance Rather Than Mechanical Perfection Should be Test of Equipment

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New Dock Fitted to Handle Bulk Cargo Efficiently

By A. H. Morrill

THE Portland Terminal Co., a subsidiary of the Maine Central railroad, has, in the past year, constructed in Portland harbor a new dock equipped with the latest type of machinery for the transshipments, from ships to cars, of coal, sulphur, fertilizer, China clay and other bulk commodities.

This plant replaces a former plant which was destroyed by fire in September, 1929. The new wharf, which is of pile and timber construction, has a face length of 610 feet and carries two steam operated diggers and three loading tracks. Thirty cars may be set for loading at one placement, these being moved by heavy duty haulers mounted on the diggers. The berth, which is adjacent to the main ship channel, has 30 feet of water at mean low tide.

Adjacent to the wharf is a service yard with capacity of 160 cars. This yard is directly connected with the Terminal company's main classification yard about 1¼ miles distant.

The diggers, which were furnished by the Mead Morrison Co., are equipped with 3-ton clam shell buckets and have a capacity of 550 tons each per hour in free digging, or 250 tons per hour each "through the ship." The two diggers, exclusive of trimmers on the ship, are operated by one foreman, three operators, two firemen, two chutemen and one groundman.

Discharging time for a 4000-ton ship is about eight hours. The steamer PLYMOUTH, which discharges regularly at this plant, carries 8200 gross tons and the discharging time averages 17 hours.

River to Rail Terminal Fitted for Handling Tinplate

By R. L. Sayre

THE Heekin Can Co. River-rail terminal is located on the Ohio river at Cincinnati, and is used to transfer tin plate from river barges to railroad box cars, serving the two Heekin Can Co. plants at Cincinnati and Norwood, O., with their raw material.

The movement of the tin plate originates at Weirton, W. Va., on the Ohio river near Steubenville, O., where the plate is loaded in steel barges which are equipped with removable hatch covers. These barges have a capacity of 800 tons at 9 feet draft and are bulkheaded on all sides and divided into three compartments for additional security, as the cargo has a value of approximately $100 per ton. The cargoes are brought down the Ohio river to Cincinnati, a distance of about 500 miles by the Union Barge line.

This river-rail terminal was designed for the express purpose of handling tin plate and therefore a few features which would allow the terminal to handle a variety of materials have been sacrificed. The plant consists of a merchandise unloading tower with 6000 pounds capacity which was designed and erected by the Mead-Morrison Mfg. Co. The railroad switch serving the terminal is at right angles to the river and will accommodate four cars along the loading platform. The crane runway extends over two car lengths of the switch so that material can be loaded directly into gondolas.

The crane operator is in a cab on one of the pier legs and can look down into the barge hatches and can also see the length of the runway into the terminal. The crane boom extends across the barge, and is stationary, so the barge is moved up and down the river by electric car pullers under control of the crane operator, in order that every part of the hatch can be reached by the hook. The tin plate is loaded in rows crosswise of the barge so that an entire row can be unloaded without moving the barge.

The tin plate is in double units with an average weight of 4000 pounds, wired tightly, and resting on 2 x 2-inch blocks and is picked up by an L-shaped fork which is slid under the package between the 2 x 2-inch blocks. These blocks are fastened to the package so that when the unit is carried into the terminal it is let down on the floor at the transfer station resting on the same blocks. The unit is then picked up by an electric lift truck using regular tin plate forks and deposited in the box car. The common unit of tin plate is ten boxes weighing about 2000 pounds but the above unit consists of two 10-box units wired together.

In operation, the terminal requires a crane operator, a laborer in the barge, a barge man, a laborer at the transfer station, an electric truck operator, a laborer in the cars, and a superintendent, or seven in all, and with this crew the terminal loads eight cars of 50 tons each, or 400 tons, in nine hours.

The terminal has been in operation over two years and has proved a very good investment. It has met the expectations of the company in every way and seems to be an ideal arrangement for its purpose.

Science Aids Ship Stowage Reducing Damage

By Dearborn Clark

THE analogy between correct stowage of a vessel and perfect outturn is not a matter of guesswork and hope, but the result of the application of scientific methods developed by research, plus systematic care and planning. Although a systematic approach to vessel stowage is no innovation with the modern ocean carrier, few shippers and consignees realize the lengths to which the modern steamship operator has gone and is going to gain a concrete and practical knowledge of that commodity relationship so essential to the procedure of proper stowage.

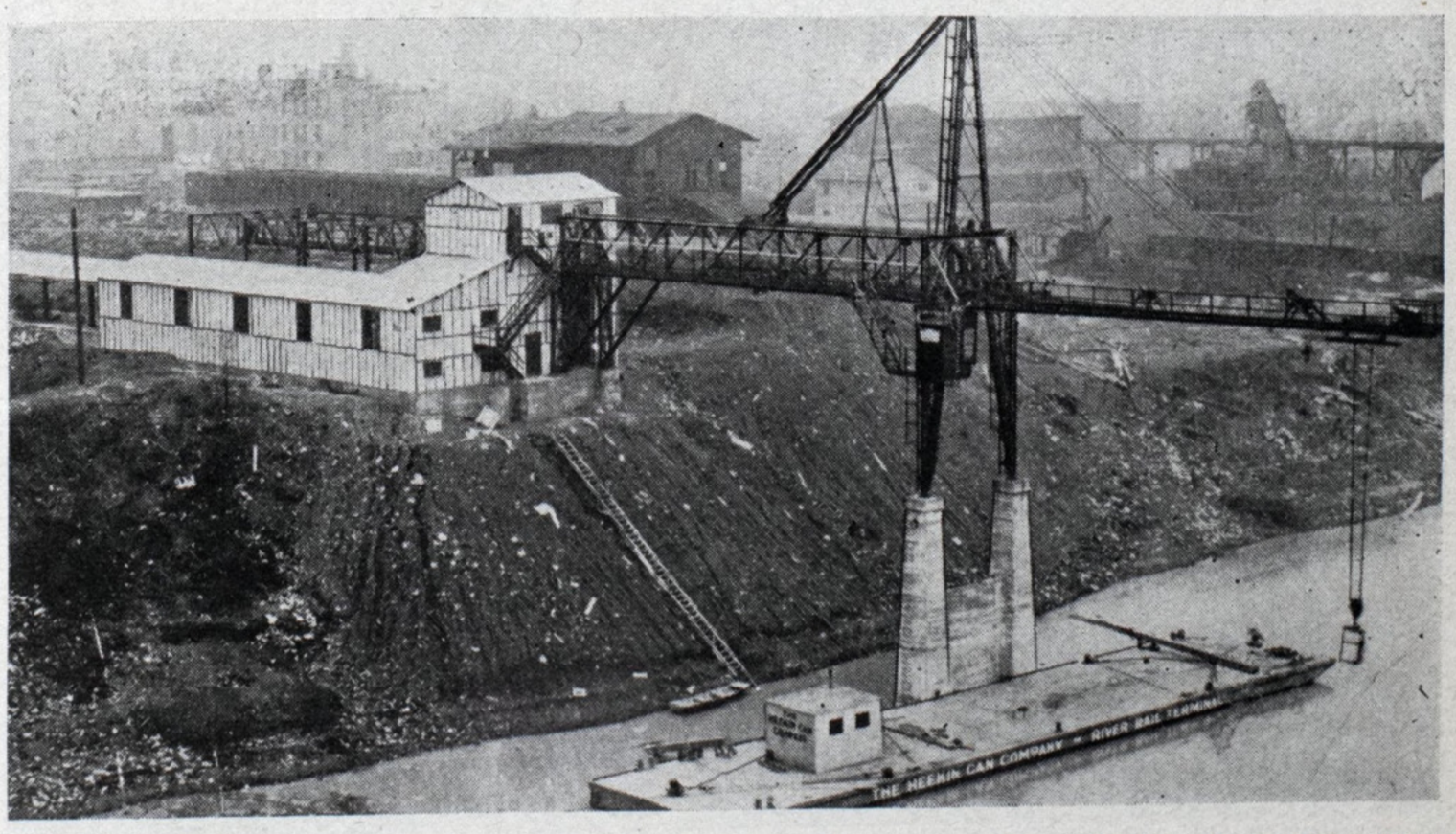
In sailing ship days, stowage had to be, and was, an art. The necessity of making every foot of space count, together with the realization that the sailing vesel would not only roll and toss, but sometimes be on her beam ends for hours or even days at a time, precluded anything but the most slow and careful stowage. With the sailing ship displaced by the steamer, some of this difficulty disappeared. However, the operator was relieved of some stowage problems, only to be faced with many additional ones, due to the vastly more numerous commodities carried and to competition in manufacturing, which latter resulted in more fragile containers. Obviously a barrel or heavy wooden packing box required much less careful handling than the modern carton, and so it has been necessary for the water carrier of today to employ research and careful, systematic planning in handling the stowage of a modern steamer.

The problem of handling those commodities that give off or absorb moisture and cause "sweat" is yielding somewhat to the constant hammering of the American-Hawaiian Steamship Co.'s research department. Although this old problem of "sweat" has not as yet been solved, some progress in controlling, and to some extent preventing it, has been achieved through improved methods of ventilation. Moreover, this is only one of the scores of instances in which scientific research supplemented by sytematic care is being directed toward overcoming hitherto baffling and costly difficulties; showing that the modern steamship operator cannot be content to be merely a transporter of cargo, but must be an expert and technician as well.

The matter of ventilation is something that is being studied painstakingly and exhaustively. During 1930,

(*Continued on Page* 52)

The author, Dearborn Clark, is assistant traffic manager of the American-Hawaiian Steamship Co.



River-rail terminal on Ohio river at Cincinnati serving the Heekin Can Co. Tin plate lifted vertically about 75 feet is moved into shed in packages

Bulk Cargo Handling Crane Installed at Baltimore

By W. G. Hildebran

THE Western Maryland Railway Co. has recently put into operation on pier 6, Port Covington, Baltimore, a bulk material handling gantry crane which incorporates a number of unusual features.

This crane, which is used for the unloading of special ores and other bulk materials from ocean going ships, is of the self propelling, full portal gantry, man trolley type, with a hinged horizontal cantilever on each side over-hanging the water. The trolley is equipped with a multiple rope, heavy duty ore bucket. Separate duplicate hoist units lift and lower the booms.

The bucket discharges into a traveling receiving hopper, fitted with a motor operated gate, which delivers the material, in selective quantities, into a traveling hopper carried on scales, where it is weighed, and discharged through a second motor operated gate, through hatches, either directly into open railroad cars, or into box car loaders, one being mounted on each main sill of the crane. When weighing is not required, the weighing hopper serves merely as a chute. The crane is carried on 24 spring mounted truck wheels, one half of which are driven by two motors, through gears and shafting, one motor being located over each end sill on the main structural framework.

The bucket, hoist and hold, and the trolley travel and main crane travel units are controlled from the operator's cab on the trolley.

Receiving hopper gates, the weighing hopper gate, scales and hopper travel are controlled from a cab on the traveling hopper framework. The loading chutes are operated from a platform accessible from the cab on the traveling hopper framework.

Incoming power is 550-volt, 3 phase, 25 cycle alternating current and all motions are operated with this power, with the exception of the bucket hoist which is operated on 230-volt direct current, supplied by a motor generator set to secure close regulation of this motion by means of Ward-Leonard control with the advantages of dynamic braking when lowering. The hoist clutch and brake are power operated, by a single hand lever in the operator's cab.

The principal dimensions of the crane are as follows:

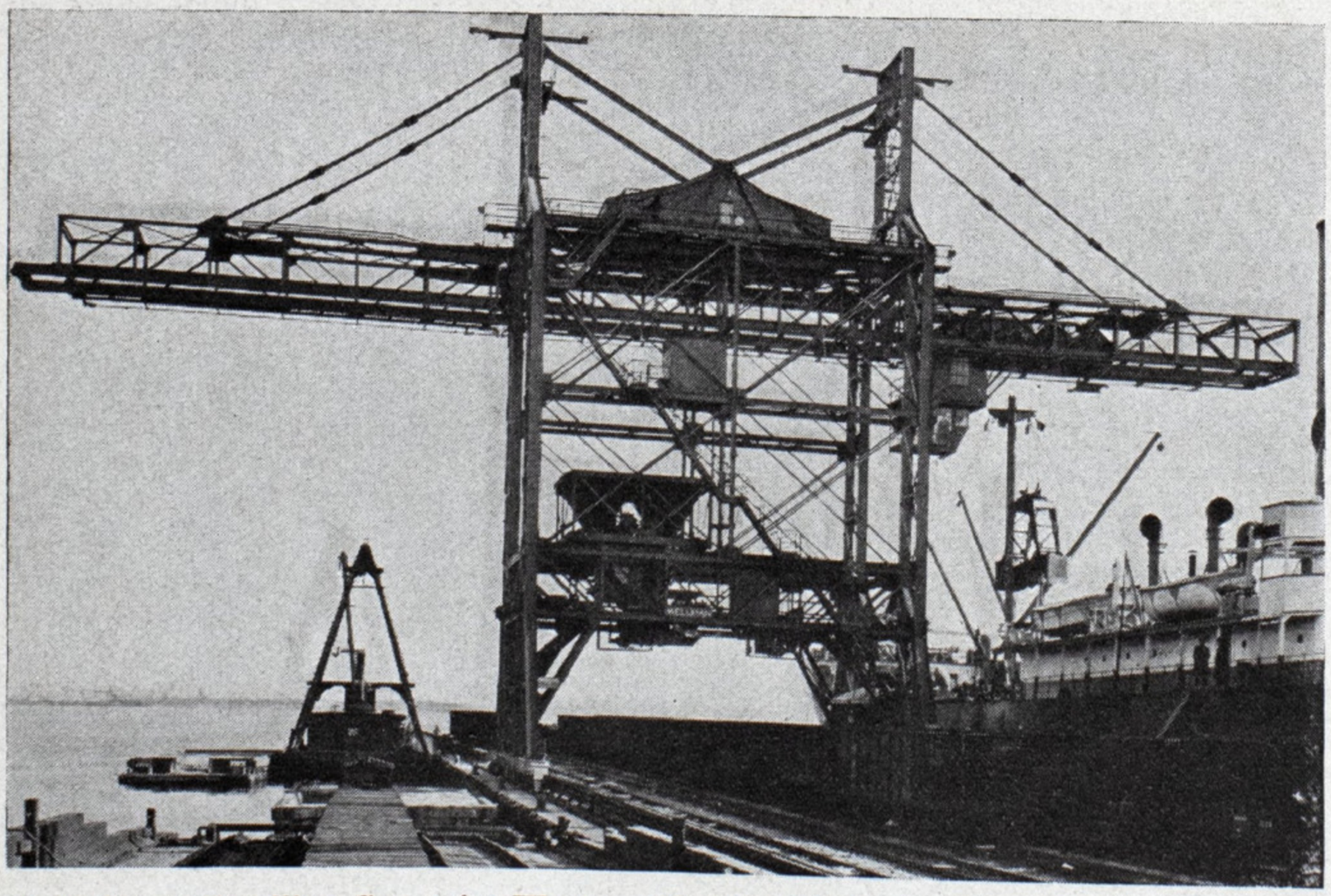
Span, center to center of crane tracks, 57 feet 10 inches, trolley travel, 163 feet 10 inches; lift above pier rail, bucket closed, 52 feet lift below pier rail, bucket closed, 40 feet; overall length of crane at sill, 70 feet; height from top of pier rail to top of trolley runway, 73 feet.

The crane, which was designed and constructed by The Wellman Engineering Co., Cleveland, is fitted with a 9-ton bucket and has a capacity of unloading at the rate of 400 to 650 tons per hour depending upon the material and type of boat.

A car puller, located at each corner of the crane, is used for spotting cars. The various motions are driven with General Electric motors and controllers (there being a total of 17 motors having a combined horsepower of 855) as follows:

Motion	Number	Horsepower
Bucket hoist	1	450
Trolley travel	2	50
Boom hoist	2	50
Receiving hopper gate	1	15
Weigh hopper gate	1	7½
Hopper travel	1	7½
Loading chutes	1	5
Box car loaders	2	20
Bridge travel	2	50
Car pullers	4	7½

The author, W. G. Hildebran, is assistant secretary of the Wellman Engineering Co., Cleveland.



Bulk Cargo Handling Crane for Western Maryland Railway Co. on Pier 6 Port Covington, Baltimore. Designed and Built by the Wellman Engineering Co.

Science Aids Ship Stowage

(*Continued from Page* 51)

under the direction of the company's research department, American-Hawaiian masters took over 35,000 temperature readings in the holds while vessels were in all intercoastal latitudes and longitudes. The results of these thousands of readings may prove of the most far-reaching benefit. For one thing, the ships' holds have been forced to relinquish at least some of their age-old secrets, and the knowledge thus gained is bound to be helpful in developing measures to stop damage before it occurs. A good illustration of this is in the case of sugar, which is often found on discharge to have become caked. Diligent research was carried on, preventive measures taken ond now, while the trouble has not been completely eradicated, the cause is believed to have been determined and to be one that will come under very nearly absolute control. The same thing holds true of "white rust." While we do not claim to be able to prevent this, we do believe we have discovered the cause, and in time persistent effort will perhaps establish a means of prevention. These are only a few of the examples of the efforts being made toward accomplishing perfect outturn on our vessels, and we believe that these efforts will be increasingly effective as time goes on.

While bearing in mind that the scientific measures being taken by the American-Hawaiian company to solve some of the most acute stowage problems are still in the experimental stage, they have already yielded excellent results. Scientific research applied to commodity relationship has helped materially in keeping damage claims of 1930 down to 89/100 of 1 per cent of the freight revenue—by far the lowest of any major cargo carrier.

United Fruit Co. reports for the quarter ended March 31 a profit of approximately $3,087,000 after depreciation, but before Federal taxes, compared with $3,800,000 in the same period of 1930.

Useful Hints on Cargo Handling

LABOR productivity in cargo handling is the title of an article in the monthly labor review for February published by the bureau of labor statistics, United States department of labor. This article by Dr. Boris Stern is based on an elaborate research into the handling of various commodities.

The first commodity is that of case oil which is refined oil in five gallon containers packed in uniform boxes two containers per box.

Three methods are used in loading case oil. The first method used in San Francisco and in New York in loading from lighters to ship differs very little from the usual handling of general cargo. Ship's gear is used exclusively and two winches and two falls are used for each hatch. Cases are lifted on platform or airplane slings aboard the ship and into the hatch by a joint operation of the two winches and there stowed into the hold of the ship. San Francisco shows an average of 825 cases or 31.2 long tons per gang hour and 49 cases or 1.86 long tons per man hour while New York shows an average of 857 cases or 32.5 long tons per gang hour and 45 cases or 1.71 long tons per man hour.

Using Ship's Gear to Load

THE second method, used at the refineries of Philadelphia and New York also utilizes ship's gear. In Philadelphia three falls are employed, one for lifting the case oil slings from the apron of the pier to the deck of the ship along a system of platforms. When the sling load is landed on the deck a special deck man releases the hook of the pier falls dropping it back on the pier for another sling load. Another deck man attaches the hook of one of the two up and down hatch falls to the sling load on the deck of the ship and the oil is loaded into the hatch and then stowed in the ship by men in the hold. In New York the prevailing Burton system is used except that the refineries supplies one winch and winch operator for lifting the case oil from the pier to the deck of the ship. While the sling load is still being lifted from the pier to the ship and before it is landed on the deck the Burton man throws the hook of the up and down falls around the sling load so as to attach it to the load. By starting the ship's winch the sling load is then moved athwartship and is lowered into the hatch.

In both New York and Philadelphia longshoremen loading case oil are especialy trained for this work. The gang used in Philadelphia averages about 23 men while the New York gang averages 17. The productivity per gang in Philadelphia is higher than in New York. Since in both ports only two hatches can be loaded at one time greater ship dispatch seems to be obtained at Philadelphia than at New York. On the other hand the output per man per hour seems to be larger in New York than in Philadelphia. In New York the average output per man per hour is 2.95 tons or 78.2 cases while in Philadelphia it is 2.65 tons, 73 cases.

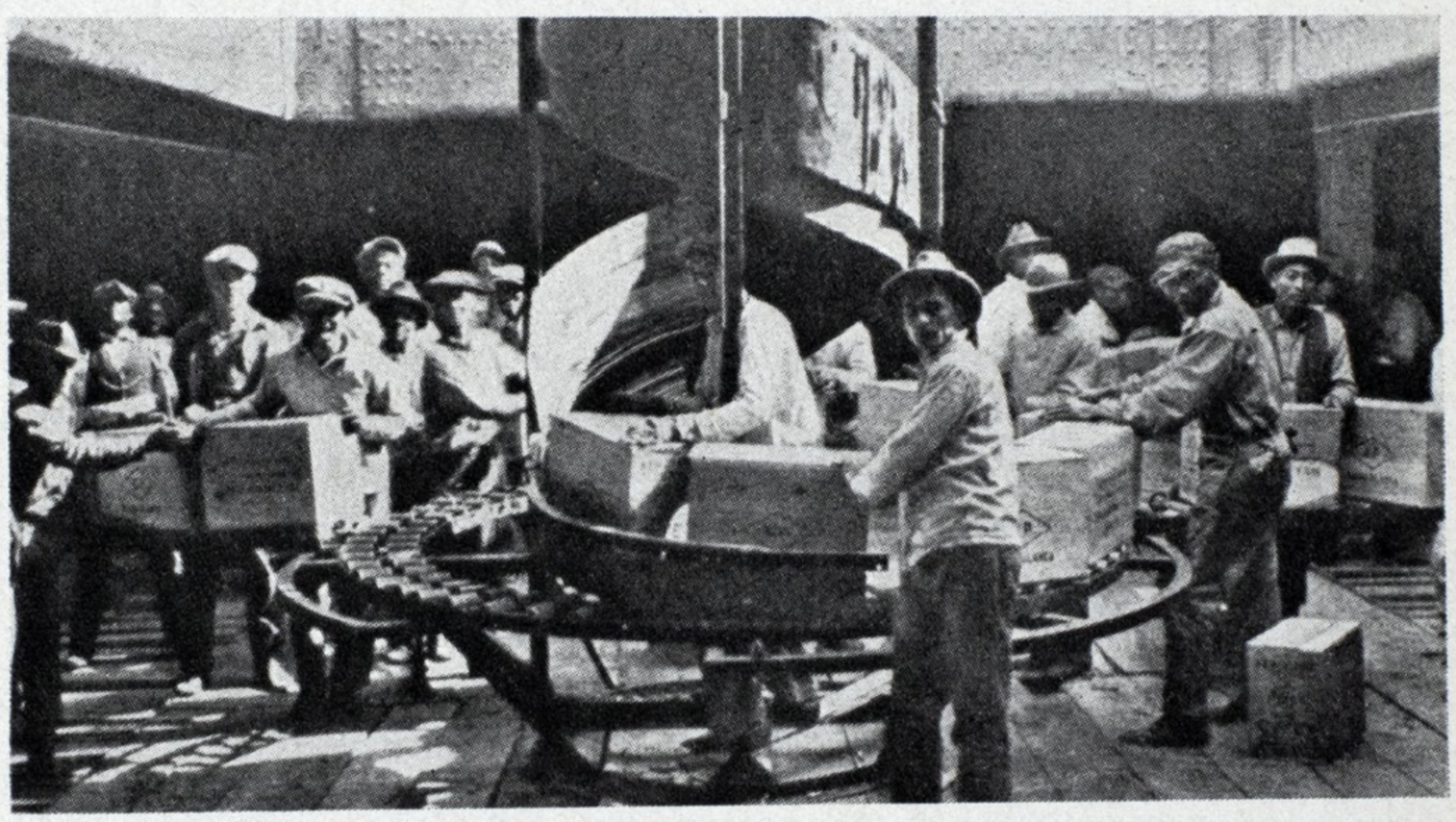
THIS page is being devoted to short items on all matters having to do with the more efficient turnaround of ships. These items are intended to be of a helpful nature.

We will welcome for this page brief descriptions, illustrated if possible, of any better or safer way of performing any function in cargo handling. Also, any questions submitted will be answered by the editor.

Using Conveyors for Loading

THE third system of loading case oil is used at the refineries of Port Arthur and New Orleans. Here cases are delivered to the pier from the warehouses of the refineries by belts and gravity rollers. The piers at the refineries are equipped with specially built spiral conveyors which are lowered into the hold of the ship by a crane supported by a movable tower which travels on rails along the entire length of the pier. By gravity rollers the individual cases are delivered to the conveyor and then down into the hold of the ship. The base of the spiral conveyor is equipped with a ring of gravity rollers and the individual cases upon leaving the spiral conveyor are diverted along the several short lines of gravity rollers scattered throughout the hold of the ship. The only work performed by the longshoremen consists of rigging the ship and removing the cases as they come from the rollers and stowing them in the hold.

Only one conveyor is used at the refinery in New Orleans while at Port Arthur there are two similar spiral conveyors and it is therefore possible to load two hatches simultaneously. The speed of loading is limited only by the ability of the men to remove the cases from the conveyor and to stow them in the ship. A single conveyor can supply a ship with 4000 to 4500 cases per hour but the actual quantity stowed is considerably below this capacity.



Loading Case Oil with Spiral Conveyor at New Orleans. Inside Hatch

When the survey was made in New Orleans in 1927 on which this article is based the spiral conveyor at the refinery had been used for only a short time and the statistical data for this port are based on a small number of ships and for a shorter period of time than in the case of Port Arthur. In Port Arthur the productivity of labor is more stabilized with an output for the two lines averaging 2029 cases or 76.2 long tons per gang per hour and 88.2 cases or 3.31 long tons per man per hour. For New Orleans the average productivity per gang hour is 1823 cases or 68.2 long tons per gang per hour and 55.3 cases or 2.07 long tons per man per hour.

Reviews of Late Books

Oil Tankers, by R. W. Morrell, consulting naval architect and marine engineer, second edition, revised and enlarged, cloth 342 pages, 6 x 8½ inches, published by the Simmons-Boardman Publishing Co., New York and supplied by MARINE REVIEW, Cleveland for $4 plus 15 cents postage and in Europe by the Penton Publishing Co., Ltd., Caxton House, London, for 20s, postage extra.

This volume is a complete and authoritative treatise on oil carrying vessels, the handling of bulk oil and the transportation of bulk oil by water. It covers the subjects of modern design, construction, repairs and operation with respect to hull, cargo system and machinery. Oil burning vessels are considered with respect to their oil tight compartments. Safe methods of pumping and loading oil are stressed. The author takes up in order the following subjects: requirements of the trade, economical speed, propelling machinery, structural arrangement, structural design, structural notes, structural members, tonnage measurement, freeboard, fire prevention, fire protection, repairs, cargo oil piping, operation, oil tank barges, and hydraulic method of handling.

The second edition has been completely revised and enlarged and reset in larger type and format. The number of illustrations has been doubled with the inclusion of photographs and drawings of the latest designs. This book is one for every marine executive. It would be found useful by marine superintendents, port engineers, purchasing agents, naval architects, marine surveyors and inspectors, deck and engine officers on oil tankers and on all vessels using oil as fuel.

The Wreck of the Dumaru, by Lowell Thomas; paper, 271 pages, 5¼ by 8 inches; published by Doubleday, Doran & Co. Inc., Garden City, New York, and supplied by MARINE REVIEW for $2.50, plus 15 cents postage; in Europe by Penton Publishing Co. Ltd., Caxton House, London, for 12s 6d, net.

The circumstances of the wreck of the DUMARU, in the fall of 1918, while the allies were engaged in the last days of the great war, had largely been forgotten by the world at large. A war built wooden ship, the DUMARU sailed from San Francisco with a cargo of gasoline and munitions bound for the Hawaiian Islands, Guam and the Orient. In her crew were many misfits and trouble makers. A few miles off Guam the ship was struck by lightning, taking fire, and had to be hurriedly abandoned. Officers and crew escaped in two lifeboats and one raft. This book deals with the horrible experience of the 32 men in one of the lifeboats which drifted and sailed some 1300 miles for 24 days before bringing up on the island of Samar of the Philippines group.

Of the 32 men leaving the DUMARU only 14 landed safely on the beach at Samar and these 14 could have held out but a matter of hours longer.

The story is told by one of the survivors, the first assistant engineer, now a chief engineer on the Great Lakes. The extremities in which the men in the open boat found themselves, including cannibalism, is told with absolute realism. It isn't a story, it is a true log of a horrible experience transcending even the imagination of fiction. Strength and weakness appear from unexpected quarters in the motley crew of the lifeboat. It proves to be a leveler of rank and the strength and ingenuity of the third assistant (he develops a still for condensing small quantities of fresh water from salt) stand out in contrast with the weakness and failure of the chief engineer.

A soft appearing boy with natural timidity outlasts George the Greek, who has the strength and disposition of the devil himself. Of the 18 men lost, two committed suicide, one an officer of the United States navy. Two lost their lives on the beach at Samar too weak to make the shore through the surf. Thirteen of the 14 who died in the lifeboat went insane before death relieved them. One of these, George the Greek, became murderously violent, threatening the lives of all others.

This is the story of the wreck of the DUMARU, and most horrible of all were the circumstances leading up to the use of human flesh to sustain life in those that remained; a thrilling true story of the sea if ever there was one.

Modern Diesel Engine Practice, by Orville Adams, cloth, 650 pages, 6 x 9 inches, over 400 engravings, published by Norman W. Henley Publishing Co., New York, and supplied by Marine Review, Cleveland, for $6 plus 15 cents postage, and in Europe by the Penton Publishing Co., Ltd., Caxton House, London, for 30s, postage extra.

This book, one of the most complete on the subject yet published, was prepared to combine a text for study and reference and a practical manual on operation and repair in one volume. It includes instructions suitable for the owner, operator, repairman and engine salesman, and is also valuable to all students. Every fact requisite to a complete knowledge of diesel engine construction, operation and maintenance is included in the scope of this book.

The information is presented in non-technical language, and is suitable for classroom use or home study. The presentation indicates a recognition of sound methods of engineering apprentice training. The author's knowledge of diesel practice, combined with his faculty of clearly presenting the subject, recommends the work to the diesel industry. Twenty-one chapters detail technical data for diesel applications, and review modern installation practice, including the standards of the Diesel Engine Manufacturers' association and the underwriters regulations for standard installation. Numerous tables, charts and operating data are analyzed.

High speed oil engines of recent design are shown and several chapters with drawings are devoted to the stationary diesel engine. All auxiliaries, air filters, pyrometers, exhaust silencers and centrifuges are described and illustrated and instructions on lubrication, maintenance, operation and repair of engines are unusually complete. The **Packard-diesel aircraft engine** and the **Ingersoll-Rand locomotive oil engine** are described and illustrated in detail, as well as the **Cummins automotive diesel.**

The Autobiography of an Engineer, by William LeRoy Emmet, cloth, 213 pages, 5½ x 8¼ inches, published by Fort Orange Press, Albany, N. Y., and supplied by MARINE REVIEW, Cleveland, for $2, plus 15 cents for postage, and in Europe by the Penton Publishing Co., Ltd., Caxton House, London, for 10s, postage extra.

This volume describes notable electrical developments throughout 45 years and is written in the form of a fascinating personal story. The book is both historical and technical in addition to being autobiographical. Some of the interesting features covered in this interesting work are: Cadet's life at United States naval academy; cruising around the world; pioneering in electrical engineering; service in the Spanish-American war; development of steam turbines; electric ship propulsion; and invention of the mercury turbine. There are ten illustrations scattered through the book. The story of the development of the mercury vapor power system should be of interest to all, whether layman or engineer.

The author, a graduate of the United States naval academy a navigator who saw active service in the Spanish-American war, who was one of the chief collaborators in the development of the steam turbine, and who really initiated electric ship propulsion work, brings into this book not only descriptions of his work as an engineer and inventor but also his association with such men as Thomas A. Edison, Samuel Insull and E. W. Rice, Jr., former president of the General Electric Co., the author's employer.

Becomes General Manager of I. M. M. in New York

PRESIDENT P. A. S. Franklin of the International Mercantile Marine Co. announced on April 1 the appointment of A. J. McCarthy, as general manager of the company in New York, in charge of the operation of all steamers and terminals. Mr. McCarthy has been in recent years manager of the company's American-flag tonnage and is well known in shipping circles in all Atlantic ports and at Washington. He entered the transatlantic trade 33 years ago, becoming manager of the Leyland line at Portland, Me., and was subsequently transferred to the International Mercantile Marine Co.'s Boston office as assistant manager, finally going to New York as an aide during the war period.

Mr. McCarthy rendered notable service during the World war, representing his company on the special patrol board of the navy, in connection with the purchasing and outfitting of many vessels participating in war activities. His appointment as manager is an excellent selection.

A. J. McCarthy

Todd Executives Promoted

At a meeting of the board of directors of Todd Shipyards Corp., New York, three executives of subsidiary companies were appointed vice-presidents of the parent corporation. The executives appointed in recognition of their long and efficient services are: J. Herbert Todd, president of Todd Dry Dock Engineering & Repair Corp., Brooklyn; George Dawe, president of Robins Dry Dock & Repair Co., Brooklyn, and George G. Raymond, president of Tietjen & Lang Dry Dock Co., Hoboken, N. Y. John D. Reilly, assistant to President William H. Todd since the inception of the Todd Shipyards Corp., in June, 1916, was also appointed a vice-president. These appointments went into effect April 1, the beginning the new fiscal year of the corporation.

Directors Are Reelected

Stockholders of the Westinghouse Electric & Mfg. Co. re-elected directors whose terms had expired and transacted routine business at a meeting at East Pittsburgh, Pa., on April 8. Directors re-elected were: E. M. Herr, vice chairman, and L. A. Osborne, vice president of the Westinghouse company; H. B. Rust, president of the Koppers company; and Samuel M. Vauclain, chairman of the board, Baldwin Locomotive Works.

Current assets as of last Dec. 31 were $115,104,125 or seven and one-half times current liabilities of $15,186,858.

A. S. Durrant Retires

Arnold Stuart Durrant, for the past six years vice president in charge of commercial relations of the International General Electric Co. Inc., retired from active service on March 1, and was made an honorary vice president of the company following a connection of 40 years with the General Electric organization.

Born in the British West Indies, Mr. Durrant was educated in England, and came to this country in 1890. Soon thereafter he entered the employe of the Edison United Electric Co., later known as the General Electric Co., and in 1896 went to Schenectady. Upon formation of the International General Electric Co., Mr. Durrant was made manager of the Department of the Americas. In 1925 he was elected vice president in charge of all commercial relations of that company.

R. J. Ringwood of San Francisco on April 7 was appointed Pacific Coast freight traffic manager of the Panama Pacific line, an American flag subsidiary of the International Mercantile Marine Co., which operates an express passenger and freight service between New York and California ports via the Panama canal. Mr. Ringwood has spent practically his entire career in the steamship business on the West coast and had been for several years past freight traffic manager of the Pacific Steamship Co.

Wins Staff Promotion

E. H. Cocke, formerly assistant passenger traffic manager, who was appointed assistant general manager of the International Mercantile Marine Co., effective April 7, will take over the work of W. H. Hoskier, formerly traffic manager of the Panama Pacific line.

Mr. Cocke joined the operating department of the International Mercantile Marine Co. in Philadelphia in 1919 and later became assistant manager of that organization. He then went to Cleveland to assume charge of both passenger and freight traffic and subsequently served as passenger manager of the Chicago office, from which position he was transferred to New York as assistant passenger traffic manager of the company with supervision over first class, cabin, second class and tourist third class business.

To Establish Organization on Pacific Coast

W. H. HOSKIER, newly appointed Pacific coast manager of the International Mercantile Marine Co., left New York on April 18 for San Francisco where he will make his future headquarters. He will devote his time immediately to the completion of plans which have been under way for some months to establish on the West coast the company's own organization and terminals for the handling of its business.

Piers have already been assigned to the Panama Pacific line at San Francisco, Los Angeles and San Diego. Freight offices for the line will be established shortly in conjunction with the International Mercantile Marine Co.'s San Francisco passenger offices in a new location. Freight offices will also be established in Los Angeles and San Diego and Mr. Hoskier expects to have the new department functioning about June 1. Mr. Hoskier joined the operating staff of the International Mercantile Marine Co. on Oct. 20, 1919 as assistant to A. J. McCarthy, manager, at a time when the company was operating 70 steamers of the shipping board. Later he became assistant manager of the company and in 1926 was appointed traffic manager of the Panama Pacific line, from which position he went to his new post at San Francisco.

W. H. Hoskier

William B. Wheeler, who resigned as passenger traffic manager of the United Fruit Co. some months ago, has been appointed assistant passenger traffic manager of the Grace line, Before joining the United Fruit Co., with which he was connected in various capacities for more than 16 years, Mr. Wheeler had been general agent of the Lehigh Valley railroad in Chicago and Buffalo and also had been on the passenger staffs of the Lackawanna, Union Pacific, Chicago, Milwaukee & St. Paul and the Chicago, Burlington & Quincy. He is recognized as a traffic expert.

Move New York Offices

The Newport News Shipbuilding & Dry Dock Co. announces the removal of its New York offices from 233 Broadway to 90 Broad street, effective April 25.

Waterway Transportation

(*Continued from Page* 28)

Everyone is affected directly or indirectly by the cost of shipping freight because of the fact that the price of goods is determined in some measure by the cost of moving them from the producer to the consumer.

Where the shipment of freight moves partly by rail and partly by water, the shipper realizes a saving of 20 per cent for the distance the waterway is used. This figure of 20 per cent has been arbitrarily set by the Interstate Commerce commission which governs the rates for joint rail-water shipment. The 20 per cent is said to reflect the saving on water shipments after the expense of transshipment which must be borne by the water carrier has been deducted. As a concrete example of the saving realized when goods are shipped part of any given distance by water, we will assume that the all-rail rate between St. Louis and New Orleans is $5. Deducting the 20 per cent allowed for water shipment, the rate between the same two points would automatically become $4. This 20 per cent saving applies in cases where freight moves part of its distance by water. An example of this would be a shipper at Indianapolis who desires to ship his goods by rail to Cincinnati and from there by water to New Orleans. The saving he would realize shipping by water would amount to 20 per cent of the all-rail rate from Cincinnati to New Orleans. In other cases, where the movement is altogether by water, the boat lines establish their own rates, which result in savings considerably more than 20 per cent of the all-rail rate. In some instances these savings are even as great as 50 per cent of the all-rail rate. (Refer to Table IV, Page 28.)

A striking instance of the savings in moving freight the entire distance by water is presented in the following. The cost of shipping farm implements by rail the entire distance from Moline, Ill., to the Pacific coast is $1.86 per hundred pounds. By rail from Moline to Baltimore and thence by water to the Pacific coast, the rate becomes $1.18 per hundred pounds. By shipping the entire distance by water, that is from Moline, Ill., down the Mississippi to New Orleans and then by intercoastal carrier to the west coast, the rate for the same hundred pounds amounts to only $0.75 which is less than half the cost of the all-rail movement.

The freight savings noted due to water transportation are actual figures from current every day operation. The inland waterway provides a natural and economic mode of transportation and as such this avenue of commerce should be developed in the same manner in which other natural resources are developed for the prosperity and advancement of the country. As brought out in the first part of this article in the April issue, the cost of improving waterways has been largely absorbed by savings in freight rates. From a study made by the board of engineers for rivers and harbors, it was learned that an annual saving of approximately $3,900,000 on the lower Mississippi river, $5,300,000 on the Ohio, and $16,000,000, on the Monongahela are realized in the transportation of freight.

Grain and farm products, etc., produced in states westward of the Mississippi river, can travel to a point on the Mississippi for loading into barges for shipment down the Mississippi to New Orleans, to be transferred there to intercoastal steamship for delivery in west coast markets; or they can be carried by river boat up the Mississippi and Ohio to Pittsburgh whence they can be moved by rail to cities on the lower lakes or eastern seaboard; or they can be carried up the Mississippi to Lockport, or Moline, Ill., to travel to large centers on the upper lakes. When the Illinois waterway is completed and the improvement project on the Missouri river will permit, great cargoes will be carried on river barges between points on the upper Missouri lower Mississippi rivers and Lake Michigan. With completion of the proposed waterway connecting the Ohio river and Lake Erie, points and interests between the two will be able to ship and receive freight direct by water.

Every manufacturing interest in the country can reap the benefits of low transportation costs made possible by the inland waterways, by shipping raw materials and finished products at least a part of the way by water, thereby enjoying the advantages of joint-rail-water freight rates. Whether freight moves east, west, north or south, it can be moved a part of the distance by boat.

(Part III Will Appear in June Issue)

New Club Elects Officers

At the first dinner meeting of the Propeller club, Port of Miami, held on March 18, R. I. Vervoort was elected president; H. V. Perry and S. F. LeCain, vice presidents; Raymond Dillon, secretary; Henry Warren, treasurer, and F. H. Henning, J. Avery Guyton, A. H. Pullen, R. W. Parker, L. F. Craig and Charles Albury, governors. The club was organized on Dec. 23, 1930 and is affiliated with the Propeller club of the United States and headquarters in New York. The port membership is composed of licensed officers of steam vessels and marine men.

M. S. Warwick Castle

(*Continued from Page* 21)

considerably in excess of this figure. The engines are of the builder's standard design. Main controls and fuel pumps are arranged at the center of each engine at engine room floor level. Fuel valve lift control mechanism is provided and the engines are mechanically lubricated.

Exhaust heat is recovered by means of a Clarkson silencer boiler unit of 500 square feet heating surface for each main engine. The boilers are 12 feet high by 5 feet 6 inches in diameter and are arranged to take all of the exhaust gases from the main engines. Each boiler under normal conditions will generate 8000 pounds of steam per hour at a working pressure of 100 pounds per square inch. The boiler in each case is mounted on an oil-fired combustion chamber 6 feet high by 5 feet 6 inches in diameter fitted with low pressure oil burners, designed for an evaporation, on oil firing, of 8000 pounds of steam per hour.

The auxiliary diesel engines exhaust through a Clarkson thimble-tube silencer boiler of 250 square feet heating surface. This boiler is 7 feet 10 inches high by 4 feet 1 inch in diameter and can evaporate 1200 pounds of steam per hour. The steam generated in these waste heat boilers is used for heating, cooking and other duties.

An interesting feature in connection with the main engines is the fresh-water cooled jackets and covers and oil cooled pistons. There are two sets of main circulating fresh-water pumps of horizontal duplex type. Each pump can circulate 225 tons of water per hour against a head of 60 feet and is driven by an electric motor of 23½ horsepower at 1300 revolutions per minute.

The auxiliary diesel engines are of Harland & Wolff 4-stroke cycle trunk piston type. The engines have six cylinders and operate on the air injection principle. The normal revolutions per minute is about 150. These engines are also arranged for fresh-water cooling of covers and jackets. Individual motor driven pumps are provided for these engines.

Four Sharples purifiers are installed for purifying the lubricating oil for the main engines. Each purifier is driven by a 2½-horsepower electric motor. Lubricating oil for the auxiliary diesel engines is purified in two similar machines. Special kind of strainers are fitted in each main engine lubricating system between the forced lubrication pumps and coolers. Strainers of similar type are also fitted in the fuel lines between the daily supply tanks and the engine fuel pumps.

At a luncheon on board the WARWICK CASTLE, shortly before her maiden voyage to South Africa on Jan. 30, R. F. Gibb, director, presided.

Graphic Comparison of Water and Rail Rates

An interesting comparison of the cost of rail and water transportation is afforded in the specific case of two trucks delivered from Clintonville, Wis., to Harrisburg, Pa. These trucks were the first two of an order of 40 to be delivered by the Four Wheel Drive Auto Co., Clintonville, to the Pennsylvania state highway commission at Harrisburg. The figures given below show that the route chosen, overland-waterways, effected a considerable saving over shipment by rail.

At a weight of 10,000 pounds each, these units shipped by rail would collect between Clintonville and Harrisburgh rail freight charges of $166.50; the cost of Great Lakes waterways transport is but $35.50 each. If to this there be added another $59.20, each, for the overland trips at either end of the water route (Clintonville to Green Bay, $8; Cleveland to Harrisburg, $51.20) the total transportation costs effect a saving over rail costs of $71.80. The detailed figures are as follows:

Railroad transportation—$1.665 per cwt. 10,000 pounds C. and N. W. R. R., Clintonville to Harrisburg	$166.50
Overland - waterways — 10,000 pounds overland Clintonville to Green Bay	$8.00
Waterways—Green Bay to Cleveland	35.50
Overland—Cleveland to Harrisburg	51.20
Total	94.70
Clintonville to Harrisburg Overland—4½ days	
14 hrs. @ $.40-5.60	$25.20
Lodging—per day $2.50	11.25
Meals—per day $2.50	11.25
Gas—per day $9.50	42.75
Oil—per day $0.25	1.15
Return R. R. fare	30.00
Sleeper	9.00
Meals	7.00
Storage—$1 per day	4.00
Total	$141.60
Railroad transportation	$166.50
Overland—waterways	94.70
Overland—925 miles	141.60

On the overland-waterways route the water rates are a decidedly important factor. The overland costs are determined on the basis of actual costs made in driving from Clintonville to Washington.

Season Slow Starting

THERE will probably be no general movement of lake boats until the middle or last of May, in spite of the fact that some lines have already completed fitting out. The Pittsburgh Steamship Co. which operates the largest fleet of bulk freighters on the Great Lakes under United States registry recently ordered engineers to start work on about 55 vessels. This line has a fleet of 86 ore carriers with a trip capacity of 732,200 tons. The fleet of the Interlake Steamship Co. is next in size with 49 boats and a trip capacity of 417,800 tons. Hutchinson & Co. ranks third with 22 boats with a 190,500 tons trip capacity. The Cleveland Cliffs Iron Co. ranks fourth with 21 boats and a trip capacity of 164,600. Other fleets and their trip capacities are as follows: Great Lakes Steamship Co. 19 boats, 144,300 tons; Bolland & Cornelius, 17 boats, 139,800 tons: Bethlehem Transportation Corp., 16 boats, 159,400 tons: G. A. Tomlinson, 12 boats 105,300 tons; M. A. Hanna Co., 10 boats, 93,500 tons; Columbia Steamship Co., 10 boats, 90,700 tons; Wilson Transit Co., 11 boats, 89,500 tons; Reiss Steamship Co., 10 boats, 76,800 tons.

There are 335 boats with a trip capacity of 2,807,900 tons in the ore carryin gfleet of United States registry. If this entire fleet were in operation, it could carry the entire estimated tonnage for the year, 40,000,000 tons in 15 trips.

Is Elected Chairman of Technical Committee

H. B. WALKER, president of the American Steamship Owners association has announced that J. F. Macmillan has been elected chairman of the association's technical committee to succeed the late Edwin C. Bennett. Mr. Macmillan is technical assistant to Theodore E. Ferris, well known naval architect and marine engineer. He has been associated with Mr. Ferris for about twelve years. Mr. Macmillan received his marine training under Sir John Harvard Biles at the University of Glasgow, and has been in the services of the Fairfield Shipbuilding Co., Harland and Wolff, and other concerns.

J. F. Macmillan

He formerly was in the estimating department of the Bethlehem Shipbuilding Corp. at Quincy, Mass. He acted as technical adviser to H. B. Walker in the preparatory work which was done in Washington for the international conference on safety of life at sea, and was chosen as one of the technical assistants to the American delegation which proceeded to London in the spring of 1929.

The Merchant Fleet Corp.'s appointment of Frank J. Denniston as director of its North Atlantic district to succeed Capt. Elmer E. Crowley, who was recently named president of the corporation, was approved by the United States shipping board commissioners on April 16. The North Atlantic district embraces New York, Boston and Philadelphia.

Telephone Signals Regulate Barge Canal Traffic

With its constant use by freighting companies, the telephone has become an indispensable factor in the operation of inland waterways, affording a means for supervising, regulating and checking the movement of barge fleets. When the New York state barge canal system was opened early in April for the 1931 shipping season, word was flashed from lock to lock along the 525 miles of this waterway from Tonawanda on the Niagara river to Troy on the Hudson river as the first grain barges passed.

In the operation of this canal system, the telephone bears the same relation as block signals in the control of the railroads. Each of the 59 lock stations along the four canal systems in the state has telephone service. When a boat clears the lock, the master of that lock station immediately telephones to the next two locks ahead to report the name and type of boat coming through and the time the boat left his lock. This information serves a two-fold purpose. It allows the operator at the next lock sufficient time to prepare his station so that there will be no delay to the barge in transit. It also serves as a check on the speed of the boat. The speed limit through land sections of the canal is six miles an hour and through the river sections it is ten miles an hour.

Each lock master is required to report daily to headquarters in Albany the names of the boats that have passed through his lock during the previous 24 hours.

March Lake Levels

The United States Lake survey reports the monthly mean stages of the Great Lakes for the month of March as follows:

Lakes	Feet above mean sea level
Superior	601.70
Michigan-Huron	579.12
St. Clair	572.46
Erie	570.82
Ontario	244.67

Lake Superior was 0.17 foot lower than in February and it was 0.36 foot lower than the March stage of a year ago.

Lakes Michigan-Huron were 0.04 foot higher than in February and they were 1.62 feet lower than the March stage of a year ago.

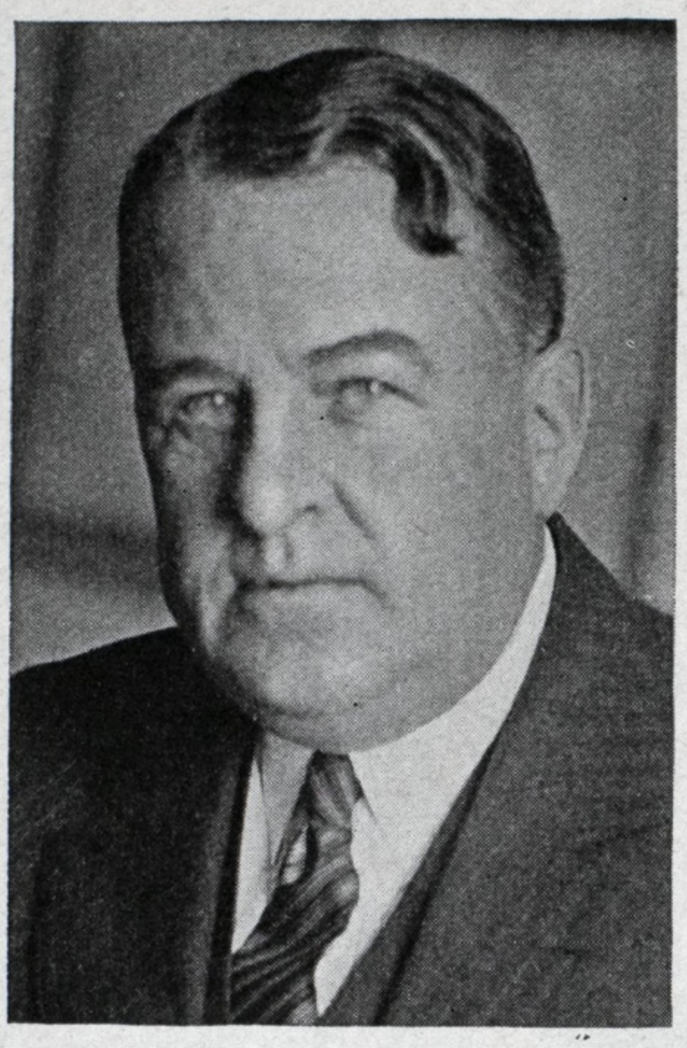
Lake Erie was 0.27 foot lower than in February and it was 2.79 feet lower than the March stage of a year ago.

Lake Ontario was 0.08 foot lower than in February and it was 2.99 feet lower than the March stage of a year ago, 0.86 foot below the average stage of March of the last ten years.

Personal Sketches of Marine Men

Capt. Elmer E. Crowley, President, Merchant Fleet Corp.

By Lynne M. Lamm



HE COMES from a New England seafaring family and has had service afloat in sail and steam.

OVER a period of 20 years he has held executive positions of responsibility in shipping affairs.

ESSENTIALLY a man of action, he brings to his new office practical experience and tried judgment.

THE nation's capital has been invaded by a new type of executive, a doer rather than a talker. He is Capt. Elmer E. Crowley, appointed president of the Merchant Fleet Corp. by its board of trustees on March 26.

Newspaper men who cover the shipping board and the Merchant Fleet corporation have found the new president somewhat of an enigma inasmuch as he refuses to be interviewed or to tell what a wonderful job he is going to do. He has never made a speech in his life. That in itself is a seven days' wonder to the newsgathering fraternity of Washington.

Captain Crowley, a well-built man, showing the result of his years of seafaring life, is modest in the extreme and refused to tell the writer what he hoped to accomplish after he has made a survey of his new job.

The captain comes from a New England shipping family, his father having sailed before the mast in 1845 as a mere boy and becoming master at the age of 19 in foreign and coastwise trade. The Crowley family are pioneers in the coastal trade of this country. Captain Crowley and his two brothers having operated first sailing vessels in 1885 and later changing to steam in 1910. During the world war they also operated in offshore trade.

Born in Somerset, Mass., the new president went to sea in 1887 as a boy, becoming a master in 1899, and continuing afloat until 1910, since which time he has held various important executive positions in the construction, repair and operation of ships. He resigned in 1921 from the vice presidency of the Coastwise Transportation Co.

Captain Crowley's life has been spent in shipping and his knowledge and integrity combined with an unusually modest disposition, make him a fitting successor for the late John R. Gordon, whose death in August of last year left the position vacant until Captain Crowley's appointment on March 26, when the board of trustees of the fleet corporation elected him.

In August, 1924, Captain Crowley was appointed special asistant to the president of the merchant fleet corporation, then Admiral L. C. Palmer, and in that capacity made a particular study of operating methods and costs for the corporation. From October, 1925, until July, 1926, he served in the office to which he now returns. He subsequently was appointed operating manager of the New York district, and last year director for the district.

Prior to his appointment as president, Captain Crowley occupied the position of director in the New York district from January, 1930, which is the largest of all the operating districts. His experience in the various positions in the corporation, and particularly in the New York district, give him an extensive background in the work which he has now assumed.

While the activities of the merchant fleet corporation since president Crowley's first tenure of office have been somewhat curtailed, due to the new form of operation under the so-called lump sum agreement, the corporation still operates through its agents thirteen lines, involving approximately two hundred active vessels; with approximately two hundred and fifty ships laid up. In addition there is a heavy responsibility in connection with liquidation involving lines sold and those to be sold. The corporation is diyided into seven major departments and has offices at the principal ports from which government vessels operate, as well as offices in Europe and other strategic world points.

The supervision of affairs of the corporation, which involve large fiscal and operating problems, will be much facilitated by reason of President Crowley's past experience with the fleet corporation and in shipping affairs generally. He will receive full co-operation from the board.

Intercoastal Conference Agreement Is Approved

An agreement among four steamship companies operating in the intercoastal trade of the United States was approved by the shipping board on April 15. These lines are the American-Hawaiian Steamship Co., the Dollar Steamship Lines Inc., the Luckenbach Steamship Co., Inc., and the Panama Pacific line.

Each of the parties to this agreement is engaged as a common carrier in the operation of vessels in the intercoastal trade between Atlantic and Pacific coast ports. Under the arrangement the representa tives of the parties are to meet occasionally at New York to consider informally conditions in the trade and the rates to be charged from time to time. Each of the lines retains the right of individual action except in respect to those instances in which, as a result of such informal consideration, the parties reach an agreement to charge the same rates on any particular commodity or character of traffic. Any other carrier desiring to do so may participate in this arrangement upon application and signature to the memorandum, while any signatory party may withdraw upon 48 hours' notice to the other parties. This arrangement is independent of and apart from any other agreement or arrangement of the parties and is not designed to continue any of the functions of the United States Intercoastal Conference, of which the parties hereto were previously but are not now members.

To Handle Lakes Surveys

The Great Lakes Underwriting Syndicate will be represented by the United States Salvage association in all damage and loss surveys on the Gerat Lakes from the beginning of the 1931 Lakes season. This supervision by the Salvage association will be exercised from its Cleveland office without setting up further exclusive offices at this time, by utilizing to a considerable extent the services of the American Bureau of Shipping's representatitves elsewhere on the Lakes, as has been done in the past.

Annual Prizes Offered

Announcement has been made by the Royal Society of Arts, John street, Adelphi, London, W. C. 2, of the Thomas Gray memorial trust prizes offered in 1931 for the improvement and encouragement of navigation, as follows:

1—Prize for an invention: A prize of 100 pounds to any person who may bring to its notice a valuable improvement in the science or practice of navigation proposed or invented by himself in the years 1930 and 1931. Competitors must forward proofs of claim on or before Dec. 31, 1931 to the secretary of the Society.

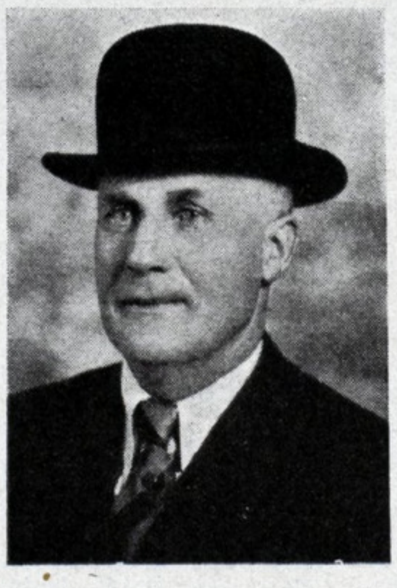
2—Prize for an essay: A prize of 100 pounds for an essay on the following subject: "The Stability of Ships, with special reference to the particulars which should be supplied by shipbuilders, and also the value of any mechanical devices for ascertaining the M. G., with which you are acquainted." Essays must be forwarded not later than Dec. 31, 1931 to the secretary of the Society.

Complete particulars governing the contest may be obtained from the secretary of the Society.

Historical Data Gathered By Veteran River Pilots

IN LINE with the interest which has been manifested during the past few years in the early history of the Northwest, the Veteran Steamboat Men's association was organized at Portland, Oreg., with offices at 581 Main street.

Captain Arthur Riggs, president of the association, has been connected with marine activity in the Pacific northwest for over 40 years. During this period he has served on more than 200 vessels and has accumulated a vast amount of historical data through the preservation of exact copies of various log books. He began his river career as a deck-hand on the steamer ISABEL on the Willamette river in 1887 and was advanced by easy stages until he was appointed master pilot. As master pilot he has commanded many of the best steamers on the western rivers, bays and lakes from the mouth of the Columbia to the innermost headwaters of this stream's tributaries and also those of the Yukon river in Alaska. For the past few years he has been engaged in piloting offshore ships between Astoria and Portland, Oreg.



Capt. Arthur Riggs

Captain Riggs has been president of the Veteran Steamboat Men's association since its formation. The sixth annual reunion of the association will be held on June 28 at Champoeg park on the Willamette river to commemorate the beginning of transportation and commerce in the Oregon territory. Over 7000 attended the annual reunion in 1930. Membership in the association is not limited to those who have pioneered as employes but is open to all who wish to aid in perpetuating these records.

Shipping Board Abolishes Fuel Conservation Unit

The fuel conservation committee of the United States shipping board, which has saved the government many millions of dollars since it began to function in 1923, was abolished on April 15. Its continuance has been found unnecessary because the majority of the board's fleet has been sold to private interests while the remaining vessels are now being operated on a lump sum basis.

In its eight years of existence the fuel section not only rendered valuable service in effecting fuel economies with the government's merchant fleet, but it aided the American merchant marine as a whole by establishing certain standards for the engineers to follow.

When the section began to function it was found that many millions had been wasted by inexperienced engineers in the then young American merchant marine. Engineering experts in the section, after a careful study of the problem, worked out a program to be followed and it was not long after that big savings became noticeable. As a further incentive, it was decided to award a bonus to the engineers of the first fifty vessels in the big government fleet which showed the best records every six months. Every succeeding semi-annual report showed remarkable savings over the preceding period.

It is doubtful if much further improvement can be made in fuel economies on American vessels as the engineers, through the experience gained by working with the fuel conservation section, have almost reached the maximum of efficiency. The importance of fuel, economies can be realized by the fact that fuel represents about 25 per cent of the total cost of ship operation.

In addition to its important work in fuel conservation the section also worked on marine engineering development and played a big part in bringing forward pulverized coal as marine fuel. It also worked with naval experts at the test plant in the Philadelphia navy yard.

The section was guided by a committee of private American engineering experts who are interested in the development of the American merchant marine. This committee has been head by Capt. C. A. McAllister, president of the American Bureau of Shipping. Other members include Prof. H. L. Seward, prof. L. B. Chapman, Col. G. Bartlett, of the Cosmopolitan line; William H. Hayes, and others.

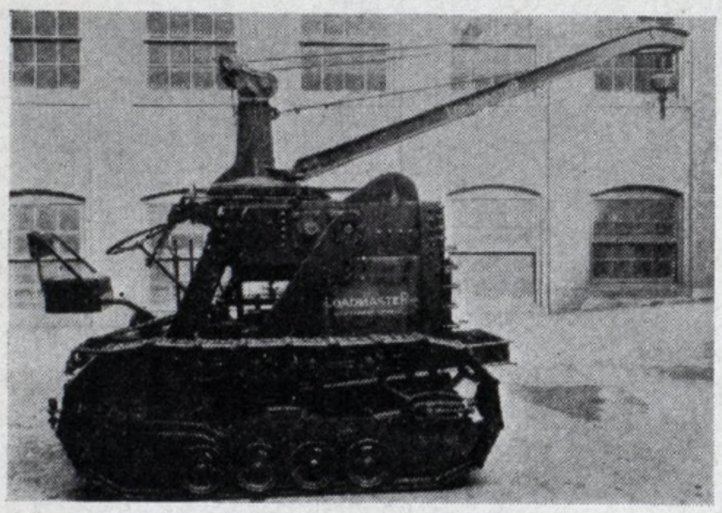
F. D. Foster has been made district manager for the France Packing Co. Inc. at Cleveland with offices at 1251 West Third street. The France Packing Co., Philadelphia, recently took over the Martell Packing Co.

Equipment Used Afloat and Ashore

Revolving Boom Crane—Special Dock Trailer Eliminates Intermediate Rehandling —Lightweight Auxiliary Engine—Inbuilt Type of Compensated Tubing

THE Bucyrus-Erie Co., South Milwaukee, recently took over the manufacture and sale of the Loadmaster revolving boom crane formerly sold by Frederic H. Poor, Inc., New York.

This mobile crane with a boom swing of 360 degrees has a rated capacity of 3500 pounds, although much heavier loads can be handled under special conditions, and a maximum working reach of 14-16 feet. The machine may be mounted either on crawlers or on rubber tired wheels, in the latter case having the maximum traveling speed of approximately 11 miles per hour. It can be used as a stationary revolving boom crane, as a crane traveling with its load or

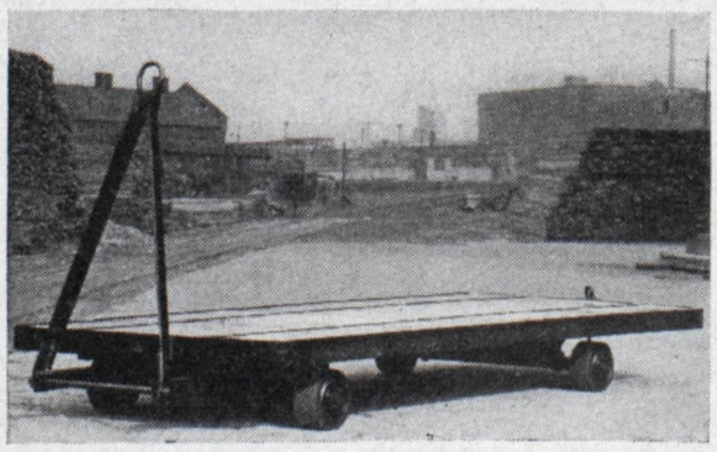


Loadmaster Revolving Boom Crane

as a tractor. Its extreme mobility and ease of handling give this one-man crane a very wide field of usefulness.

Dock Trailer Eliminates Intermediate Rehandling

THE special dock trailer shown in the accompanying illustration handles entire sling loads of freight from ship side to freight cars without any intermediate rehandling or unloading of the sling. Especially designed by Mercury Mfg. Co., Chicago, for dock purposes, these special trailers have a capacity of five tons each, are 5 feet 6 inches wide, 14 feet long, and only 17 inches high. A number of them have just been put into service by one of the large stevedoring contractors of New York and additional units will be added from time to time.



Special Dock Trailer for Handling Sling Loads

Light Weight Auxiliary Engines Grow in Favor

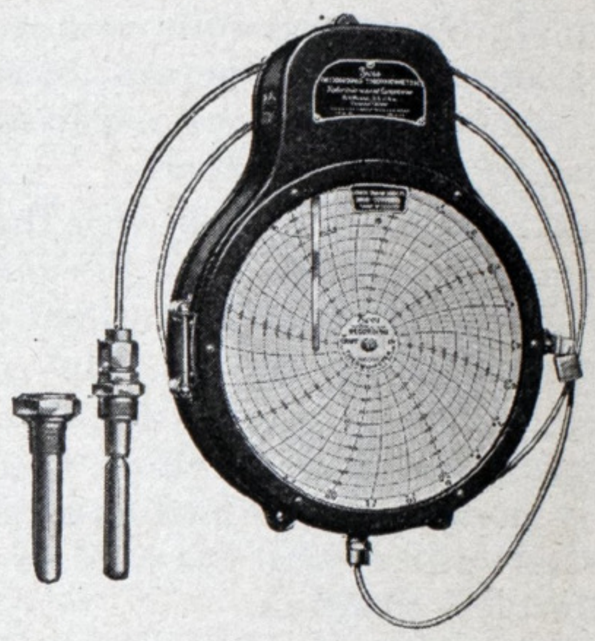
LIGHT weight auxiliary engines directly connected to generators and compressors for installation in tug boats, pleasure yachts, etc. are in great demand because they operate on the same kind of fuel as large size marine diesel engines and for this reason eliminate the necessity of carrying gasoline on board ships. The Bolinders Co. Inc., New York, recently added these light weight units to its line of marine engines, type W316A being shown herewith.

These light weight oil engines are built into auxiliary units driving air compressors, generators, pumps of all types, hoists, etc. and are made in three sizes, 6-7, 12-15 and 25-30 brake horsepower in one, two and four cylinders, respectively. Turning at 1000 revolutions per minute and burning standard diesel grade of oil, they weigh little more than a gasoline engine of the same horsepower. The construction of this type of engine is simple. The counterbalanced crank shaft is supported on S.K.F. roller bearings, producing a smooth and vibrationless drive. A built-in water pump maintains the proper circulating water in the cylinder jackets at all times.

New Inbuilt Type of Compensated Tubing

A REVOLUTIONARY type capillary tubing in which the compensating qualities have been incorporated in the material of the tube itself, has been produced by the Taylor Instrument Companies, Rochester, N. Y. No parts are added to the mechanism of the instrument and no adjustments are necessary during the life of the instrument.

Essentially the new method con-

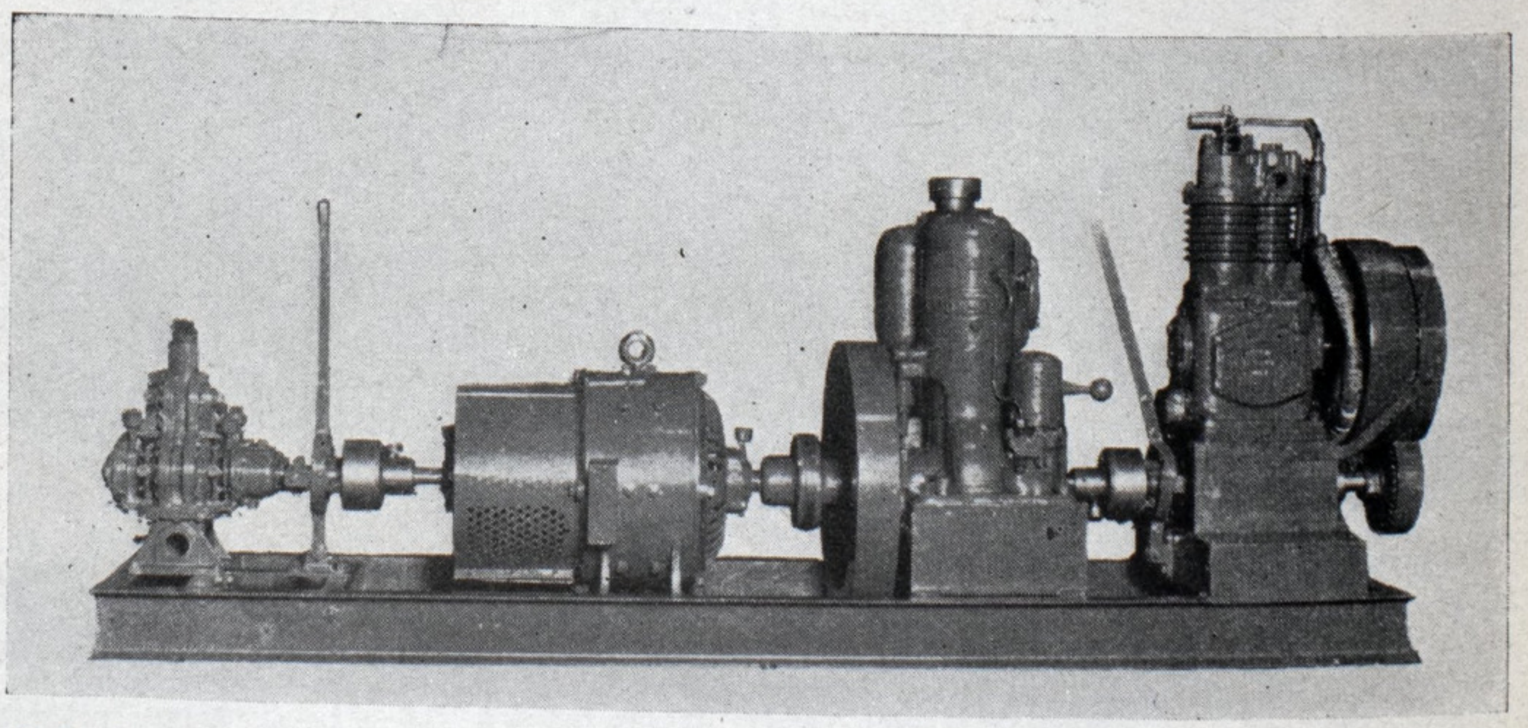


New Tycos Compensated Tubing

sists of so proportioning the volume of mercury in the tubing to its coefficient of expansion and to the size of the alloy wire, that any change in the volume of mercury resulting from external temperature changes is accurately compensated. Adjustment is made for each varying exposure and it is not necessary to compensate the instrument for the average external condition along the length of the tubing, a difficult, if not impossible adjustment to make.

To make this new development possible, it has been necessary to devise entirely new methods of producing the steel tubing, and the finished product is controlled from the standpoints of material, physical properties and accuracy of bore, within extremely close limits.

This new 7/32-inch O.D. compensated tubing is the latest step in the development of Tycos mercury actuated tube systems.



Bolinders 6-7 Brake Horsepower Generator-Compressor-Pump Unit. Length, 100 inches; width, 22 inches; height, 41 inches; weight, 1300 pounds

New Trade Publications

LOADING CHAIN—High strength with minimum weight is claimed for its loading chain in a leaflet by the American Chain Co. Inc., Bridgeport, Conn. Specifications are given.

DIESEL ENGINES—Worthington Pump & Machinery Corp., Harrison, N. J., devotes a 44-page bulletin to its vertical four-cycle air-injection diesel engines. Copious illustrations supplement the description in the text and present numerous installations in varied use. Diagrams show details of various sizes.

FORGINGS—A recent bulletin on forgings, Heppenstall Co., Pittsburgh, is devoted to information on acid open-hearth billets and miscellaneous heavy machine forge products. Several pages are devoted to useful tables of weights, equivalents and conversions and the catalog is well illustrated.

ACIDPROOF PIPE — American Manganese Steel Co., Southern Manganese Division, St. Louis, is distributing a bulletin carrying test reports of its acid-resisting pipe and fittings, with suggestions as to economy in use of this material in various ways. Its use in buildings where acid waste is conveyed is especially recommended.

LIFTING DEVICES—Ambold Machine Tool Corp., 50 Church street, New York, features its junior double-acting hoist in a current bulletin, with some mention of its other electrical lifting devices with capacities up to 10 tons. The junior hoist is illustrated and described and its advantages stated.

CONDENSATE PUMPS — Leaflets L20426 and L20447, covering both motor-driven and turbine-driven condensate pumps, have been issued by the South Philadelphia Works of the Westinghouse Electric & Mfg. Co. Characteristic curves are given showing the effect of submerge to the capacity of the pumps.

WASTE HEAT BOILERS — Foster Wheeler Corp., New York, has issued a bulletin describing its waste heat boilers, which are of a new type. It shows several designs, with illustrations of installations and details of construction. It is particularly applicable to internal combustion engines and to marine use. The bulletin is known as WB-30-2 and is available upon request.

HEATING — American Blower Corp., Detroit, has issued a bulletin on its method of heating for floor, wall or ceiling mounting with high, medium or low pressure steam applications. The method is described and various types of equipment are illustrated, with their applications. Piping diagrams are provided and ample data are presented.

MARINE CONDENSERS—Westinghouse Electric & Mfg. Co., East Pittsburgh, has issued Bulletin D.M.F. 5258 covering the company's developments in condensing equipment for marine application, including single and two-pass condensers, propeller-type circulating pumps and air injectors. Illustrations include welding features employed in the manufacture of this equipment.

GENERATING SETS—Bulletin No. 1902 covering Engberg marine generating sets was recently issued by the Troy Engine & Machine Co., Troy, Pa. Chapters are devoted to the application and guarantee of these generating sets and to descriptions of the engine and generator. A number of illustrations are included, as well as drawings and tables, and the bulletin will be sent to anyone upon request.

CLEANING COMPOUND—A booklet on the various uses of Annite, an all-purpose cleaning compound, has been issued by the Quigley Co., Inc., 56 West Forty-fifth street, New York. A chart giving a partial list of the industries Annite serves is included. On board ship it is especially recommended for general cleaning, painted surfaces, engine room, oil tanks, uniforms, salt water baths and washing in sea water.

ELECTRICAL EQUIPMENT—General Electric Co., Schenectady, N. Y., has issued recent bulletins on the following products: Atomic-hydrogen arc welding equipment, mechanical-drive turbines, semi-automatic reduced-voltage starters, thermostats, selsyns, synchronous motors, automatic full-voltage controllers, oil circuit breakers, photo electric relays, air drawing-oven, textolite gears and CR 9504 operators.

TRUCK-TYPE SWITCHGEAR—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., has issued a catalog on its metal enclosed truck-type switchgear, manually and electrically operated, built for three-phase, 60-cycle supply, 3000 amperes maximum and 15,000 watts maximum. All high-voltage circuits are enclosed, affording safety to the operator. Illustrations include halftones and diagrams and a table is given of interrupting capacities and dimensions.

INDUSTRIAL CONTROL—Catalog BEA-606B issued by The General Electric Co., Schenectady, N. Y., is devoted to representative lines of Industrial Control manufactured by the company, including data on the care and operation of control devices, wiring diagrams of standard controllers, push buttons and other accessories. Reference tables, list of publications and other useful information also are given.

MARINE BATTERIES—The Electric Storage Battery Co., Philadelphia, has issued a new booklet under the title Exide Batteries for Commercial Vessels devoted to the need and uses of storage batteries on every kind of vessel in every type of service. The bulletin chronicles briefly the development of electricity aboard ship and contains much valuable information on marine battery equipment, which is well illustrated.

DIESEL ENGINES—The Busch-Sulzer Bros.-Diesel Engine Co., St. Louis, has issued a bulletin on large diesels for public utilities. Special attention is called to the simplified design of 30-inch diameter cylinder fitted with solid injection, which is available in reversing marine diesels as well, and to the great reduction in space occupied in the new design of 3000 horsepower engine, which indicates the possibilities of large diesel electric drive installations and diesel auxiliary units for large passenger liners. The bulletin is well illustrated.

ELECTRICAL PRODUCTS—General Electric Co., Schenectady, N. Y., has just issued its biennial general catalog. This supersedes all previous catalogs except those relating to railway, mine and industrial supplies. It contains 1146 pages and is fully illustrated. It is thumb-indexed in 16 sections, generation, wire and cable, distribution transformers, arresters and capacitors, voltage regulators, switching equipment, switchgear, meters and instruments, lighting equipment, motors, motor applications, industrial control transportation, industrial heating, miscellaneous and indexes.

Business News for the Marine Trade

Wilcox, Crittenden & Co., Middletown, Conn., manufacturers of marine hardware, have approved plans for power plant extensions.

The Calcasieu Shipping Co. has been organized at Lake Charles, La. The officers are: George A. Partridge, president; Charles A. Bone and Adolph Marx, vice presidents; John A. Wasey, secretary; and George D. Neely, treasurer.

The Capiano & Post Corp. of Sea Cliff has changed its name to the Glen Cove Marine Salvaging Co., Glen Cove, L. I., N. Y. New capital has been enlisted and it is expected that the company will enlarge its operations considerably during the coming year.

The Baltimore Towage & Lighterage Co., a new enterprise, recently purchased 10 open and covered lighters in New York, and is about to begin operations. The service is to be confined to the harbor demands for lighterage movements of cargoes.

An appropriation of $1,000,000, included in the second deficiency bill, was passed by both houses of congress during February for a new appraisal warehouse for the United States customs office at Baltimore. The new building will be equipped with proper elevators, inspection space, laboratories, platforms and runways. Work on the new structure will probably begin by the end of this year.

Dredging operations have started on the new pier development project of the New Orleans Dock Board on the Industrial Canal between Florida Walk and Gentilly. The canal connects the Mississippi and Lake Pontchartrain. The projects will provide five new piers and four slips, the latter being 1600 feet long, 350 feet wide and 30 feet deep. A warehouse with a shed on either side will be built on each pier. When completed the system will provide docking facilities for forty vessels.

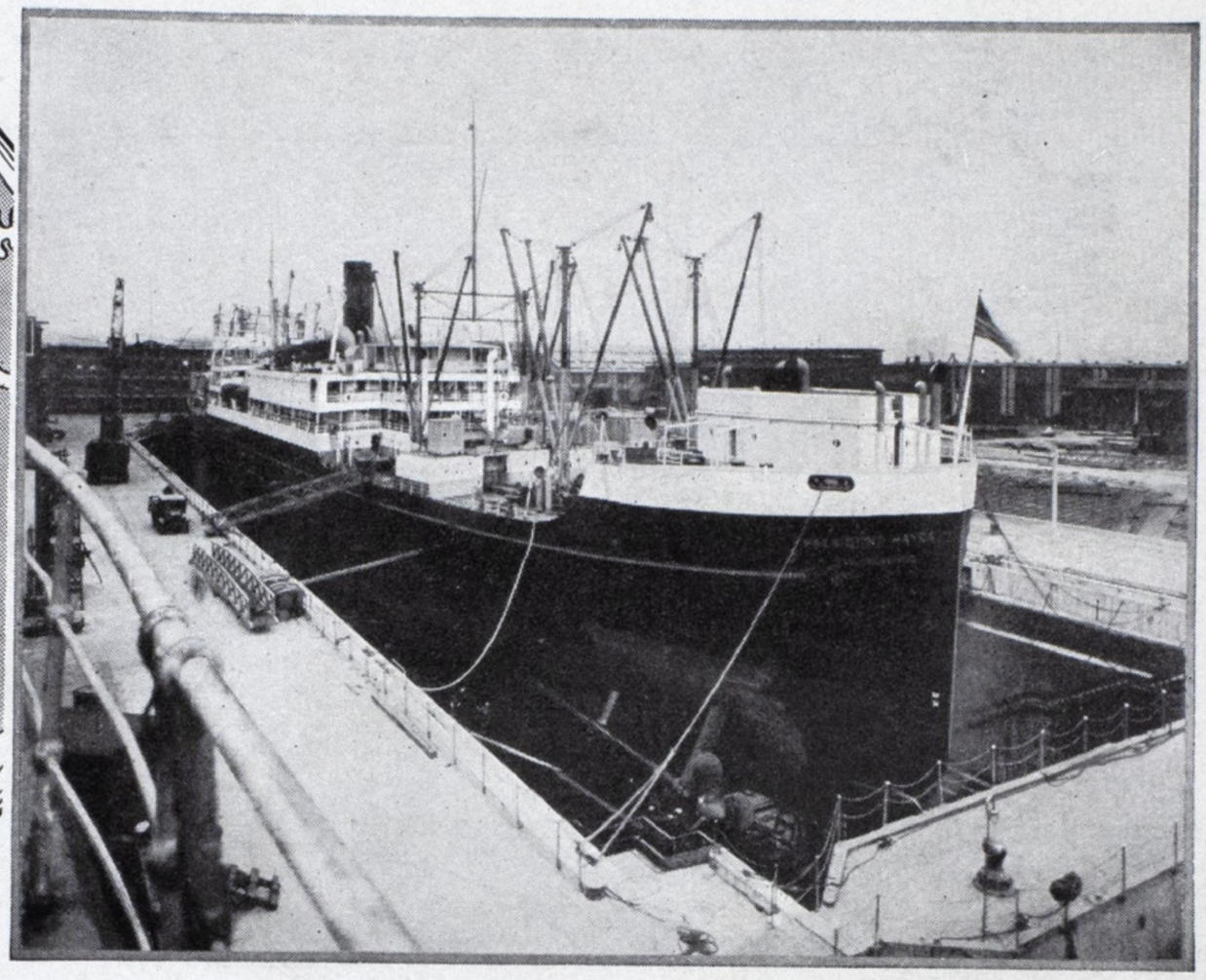
The Freighting Corporation of America has opened an office at 25 Broad street, Room 602, New York, to engage in the freight and chartering trade. Henry D. Mercer, who recently resigned as general manager and vice president of the Dyson Shipping Co., is president of the new company. D. F. Young, formerly with Funch, Edye & Co. and thereafter with the Dyson Shipping Co., is secretary-treasurer. The chartering department will be in charge of William P. Brown, formerly with Funch, Edye & Co.

Marine Review

Reg U.S. Pat. Off.

The National Publication Covering the Business of Transportation by Water

May, 1931



S. S. "PRESIDENT HAYES," *Dollar Liner* in Todd Graving Dock

THE value of Todd Service in heavy tonnage jobs lies in the facilities offered of the only privately owned graving dock in the Port of New York capable of docking vessels up to 731 feet in length.

Todd Service is complete and self-contained. All manner of marine repair, conversion, reconditioning and overhaul is accomplished within the confines of Todd Yards. Todd facilities, equipment and experienced personnel along the Atlantic, Gulf and Pacific coast lines all contribute to the efficient, prompt and economical service so characteristic of a Todd job.

TODD SHIPYARDS CORPORATION
25 Broadway, New York

PLANTS

Robins Dry Dock & Repair Co.
Erie Basin, Brooklyn, N. Y.

Tietjen & Lang Dry Dock Co.
Hoboken, N. J.

Todd Shipbuilding & Dry Dock Co., Inc.
Mobile, Ala.

Todd Dry Dock Engineering & Repair Corp.
Brooklyn, N. Y.

Todd Engineering Dry Dock & Repair Co.
New Orleans, La.

Todd Dry Docks, Inc.
Harbor Island, Seattle, Wash.

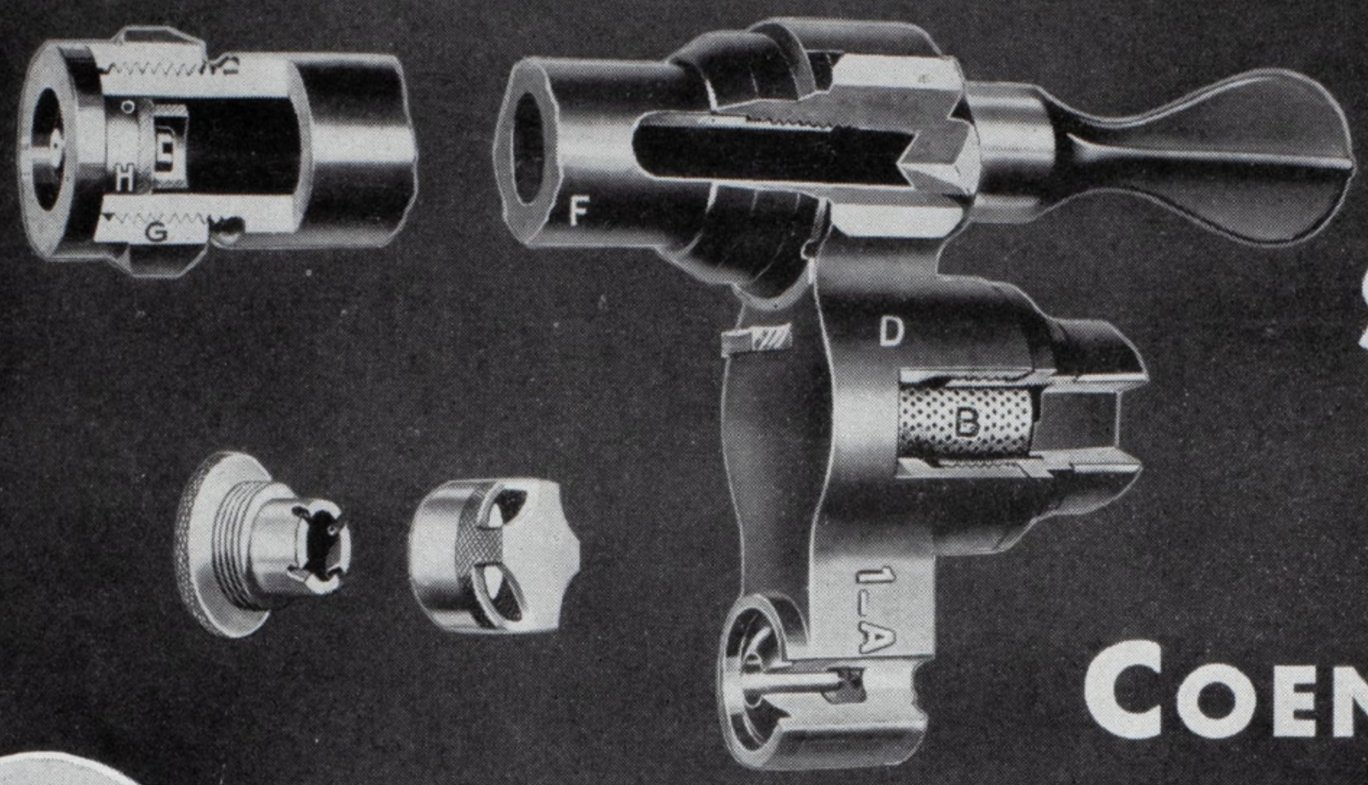
Todd Oil Burners, Ltd.
London, England.

24 Floating Dry Docks
2 Graving Docks 3 Shipways

LARGEST DRY DOCK in NEW YORK HARBOR

TODD NEW YORK, U.S.A.

SUPERIORITY PROVEN BY SERVICE



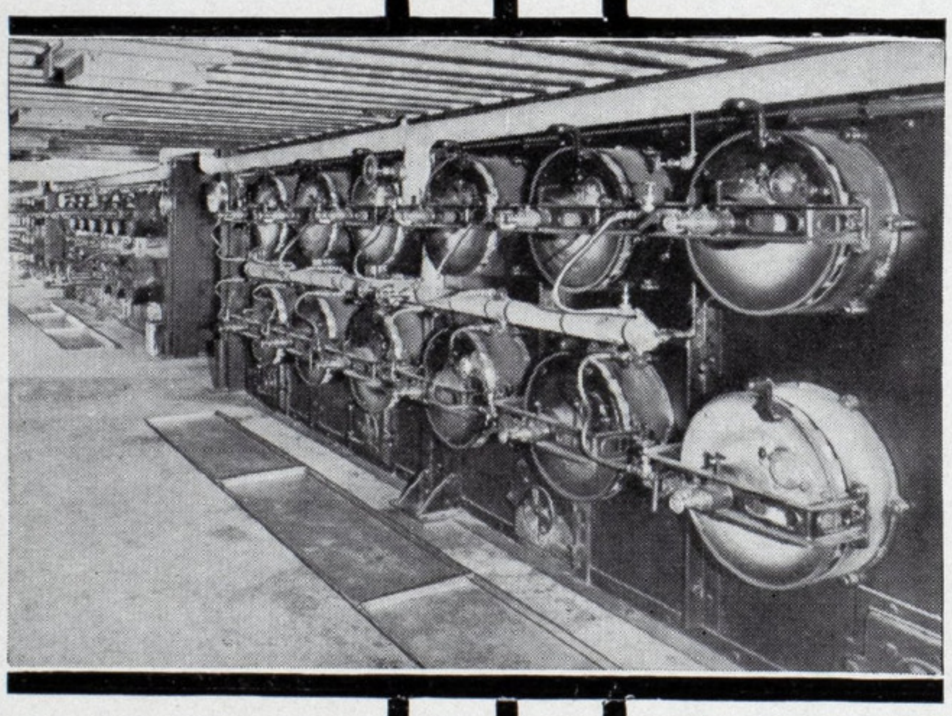
TYPE B COEN BURNERS

Do you buy on theoretical promises or performance records? Promises may materialize; service records are history that has materialized.

The Coen type "B" Burner is making history. Its extreme simplicity, its fine degree of atomization, its high range load have all been proven by performance. Its softer flame and better heat distribution saves boiler tubes, shells and furnaces. Its simple and positive control maintains constant temperatures under heavy loads without carborizing tubes or burning shells. Used with a battery of boilers, each burner has the same oil pressure, and with uniform size tips will atomize the same amount of oil making each boiler do its share of the work.

Coen Burners are built in various types and sizes for use with oil, gas or powdered fuel.

Write for Bulletin No. 17 giving full details on the Coen Mechanical Oil Burners.



A battery of Coen Burner equipped boilers.

COEN COMPANY INC.

COMBUSTION ENGINEERS

Manufacturers of Fuel Burning Systems

610 SOUTH BROADWAY, LOS ANGELES, CALIF.

112 Market Street SAN FRANCISCO — Post Dispatch Building HOUSTON — 50 Church Street NEW YORK

Vol. 61, No. 5, May, 1931, issue of MARINE REVIEW, published monthly at Cleveland, O. Entered as second class matter at the post office, Cleveland, Ohio, under the act of March 3, 1879. Subscription price $3.00 a year in U. S.; Canada, $4.00; Great Britain, £1; single copies, 35c.

Modern Steam

PRESSURE *POUNDS PER SQ. INCH*	TEMPERATURE *DEGREES FAHRENHEIT*	FUEL RATE *LB. OIL PER S.H.P. PER HOUR FOR ALL PURPOSES*
900	900	.50
600	800	.55
400	750	.60
200	500	.90

The limit has not been reached !

The possibilities of Modern Steam are by no means limited. The above tabulation not only illustrates the approximate relation existing between pressure, temperature, and fuel cost but shows the truly remarkable savings possible through the use of steam at even higher pressures and temperatures . . . higher than those adopted for marine service up to the present time.

•A reduction of 33⅓% in fuel cost accompanies the increase in pressure from 200 to 400 pounds . . . a reduction that should command the attention of every naval architect, owner, and operator. The economy secured through the use of steam at 400 pounds pressure represents the *lowest cost of fuel per S. H. P. per hour* of any propulsion system now in use. •When Modern Steam reaches of 900 pounds pressure and a temperature 900°F., the corresponding fuel rate of .50 pounds of Bunker C oil per S. H. P. per hour *for all purposes* will represent a total saving of 44.4% in fuel cost as compared with the fuel consumption of a 200 pound pressure plant. •Even the fuel rate at 900 pounds pressure is not the ultimate economy that may be reached . . . and when higher pressures are needed, a Babcock & Wilcox boiler will be ready for this service.

THE
BABCOCK & WILCOX
COMPANY

85 LIBERTY ST. NEW YORK, N. Y.

M1

The one sound way to figure

When you look at it squarely, there's really only one sound way to figure the cost of lubricating oil—on the basis of the service it gives. And that's the *cost per running mile*, month in month out.

What do you consider the major items of engine-room expense? Experienced engineers agree—overhauling, repairs, replacements, fuel and oil consumption, yearly depreciation.

Gargoyle Marine Oils cannot eliminate these costs. But they do go a long way toward holding them down. Here's why. Every grade is *made to fit* a particular type of service. The Vacuum Oil Company has specialized in scientific lubrication for 65 years.

Gargoyle Marine Oils don't work miracles. But, it would almost seem so when you look at the scores of performance records on file—five years without changing a piston ring—a million miles without a major repair. The evidence is pretty conclusive when you're thinking about oil costs.

Vacuum Oil Company representatives are stationed in more than 300 of the world's leading ports, where Gargoyle Marine Oils are stocked. A talk with one of these men usually results in a new slant on this question of cost-cutting lubrication.

We shall be glad to send you either of these valuable books without any obligation: "*Steamships with Reciprocating Engines*," "*Marine Lubrication — Motorships.*" Address Vacuum Oil Company, Marine Sales Department D-5, 61 Broadway, New York City.

GARGOYLE

Marine Oils

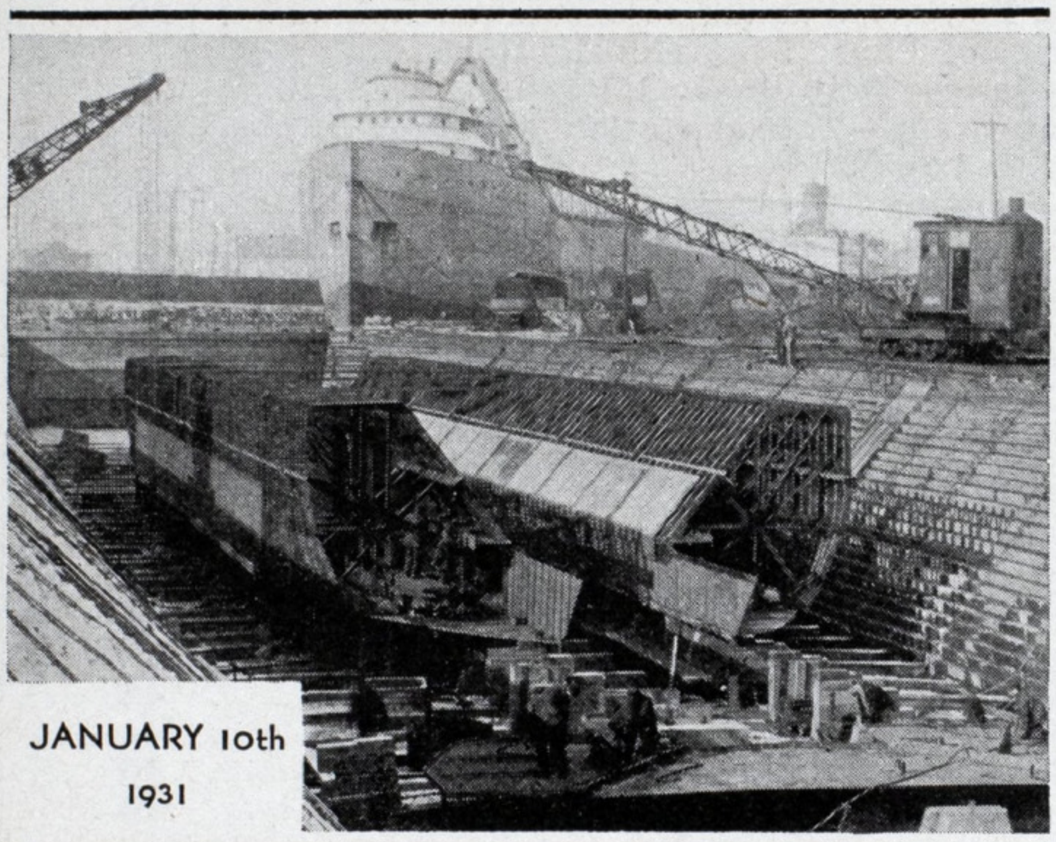
A grade for each type of service

VACUUM OIL COMPANY

WE BUILD DUMP SCOWS

Let these photographs tell

"KEEL"
JANUARY 5th
1931



JANUARY 10th
1931

JANUARY 24th
1931

HERE is a story of day-by-day progress on a scow job reported by the camera.

It says two things at least to the thoughtful reader. It reminds him that we build dump scows, car ferries, tugs, sand suckers, dredgers, freighters and every type of ship used on the Great Lakes.

And it says also that when the job starts, it goes forward fast. And is delivered per contract—or better.

It may also suggest to you some of the advantages of the strength, resources and complete equipment of American Ship and what they mean to you in the way of complete dependability when you want ship repairs or alterations.

Five conveniently located ship yards working under one policy—dependable work only—are ready to serve you whenever you say the word.

The AMERICAN

CLEVELAND
American Ship Building Co.

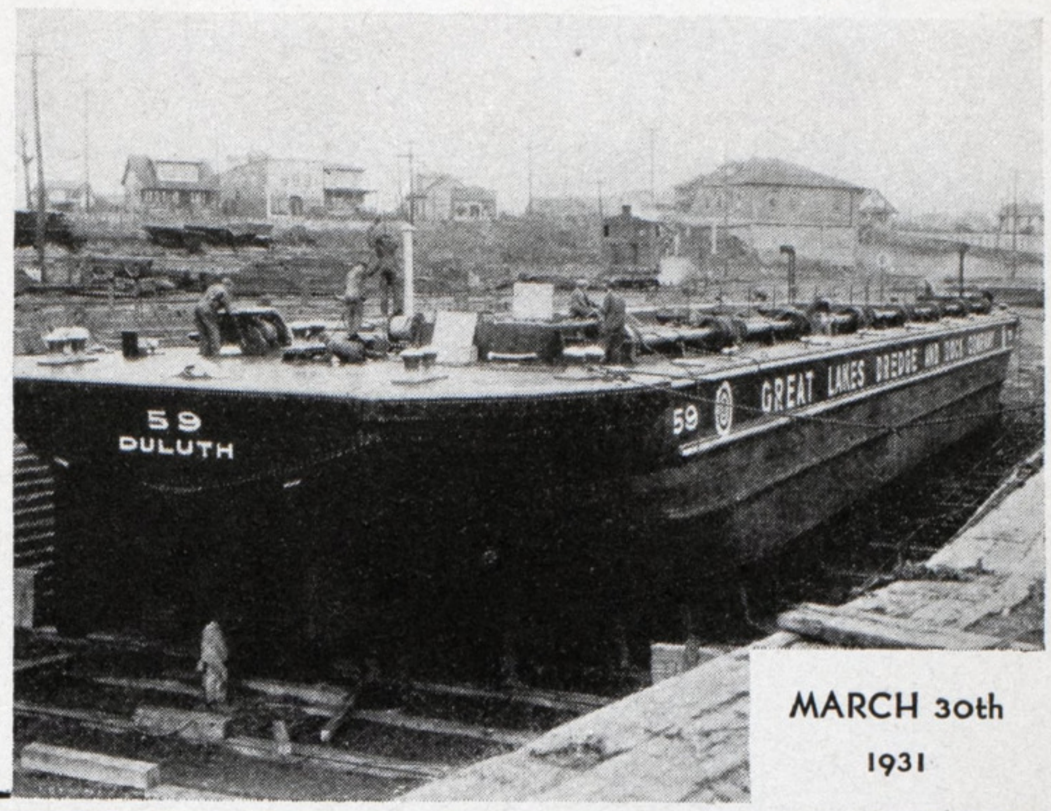
LORAIN
American Ship Building Co.

BUFFALO
Buffalo Dry Dock Company

. . and BUILD THEM FAST

you their own story of speed . . plus

FEBRUARY 9th
1931



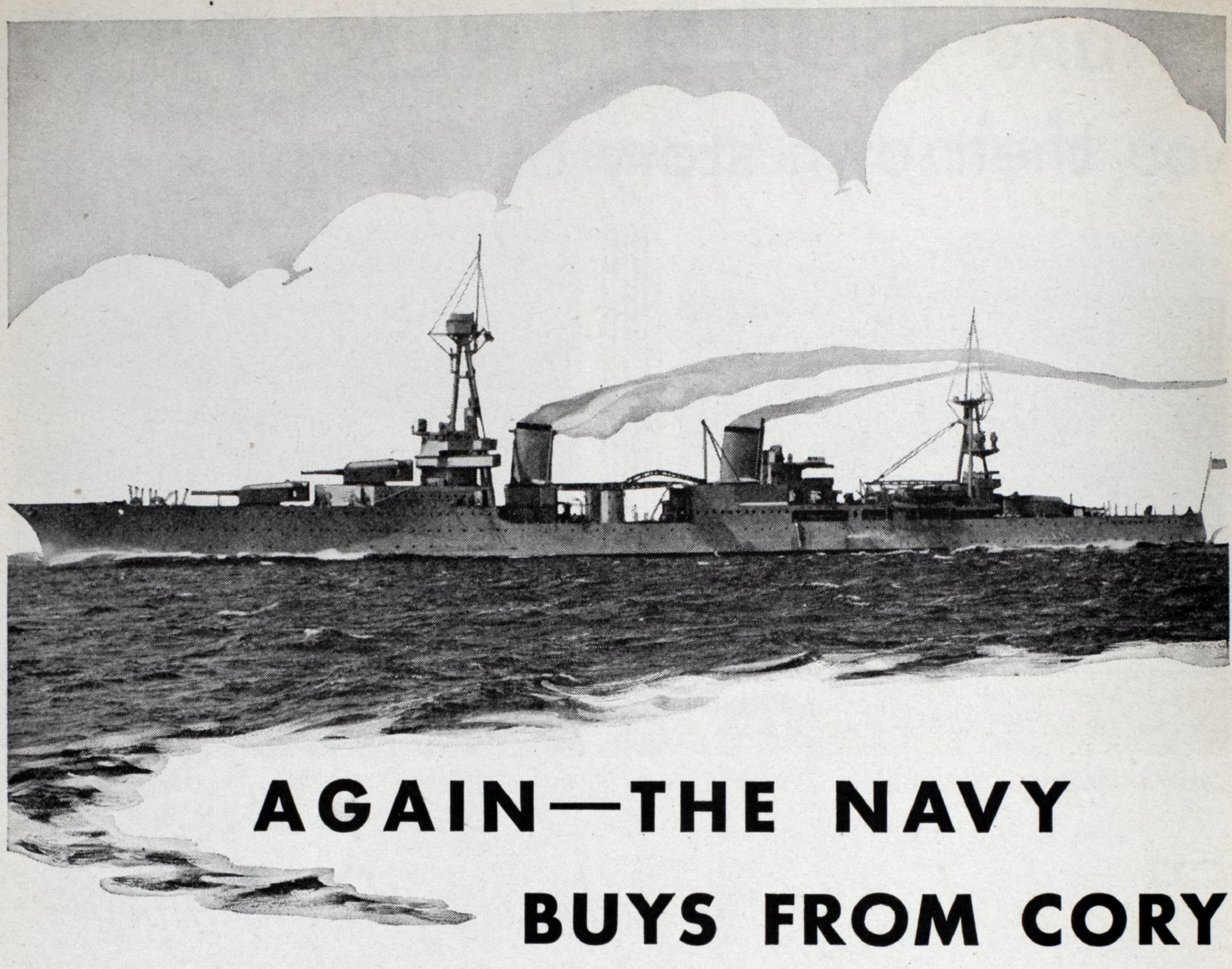
MARCH 30th
1931

APRIL 2nd
1931
"COMPLETED"

SHIP BUILDING Co

SOUTH CHICAGO
Chicago Ship Building Co.

SUPERIOR
Superior Shipbuilding Co.



AGAIN—THE NAVY BUYS FROM CORY

The photograph above shows the U. S. S. Northampton, built by the Bethlehem Shipbuilding Corporation, Ltd., and sister ship to the four cruisers now building.

FOUR 10,000 ton cruisers are to be built by the United States Navy Yards. On these ships only equipment of the most advanced type is to be installed.

Chas. Cory Corporation has been awarded the contract to design and build Engine Order Telegraphs, Rudder Angle Indicators, Fire Room Telegraphs, Speed Flags, and similar equipment for these ships.

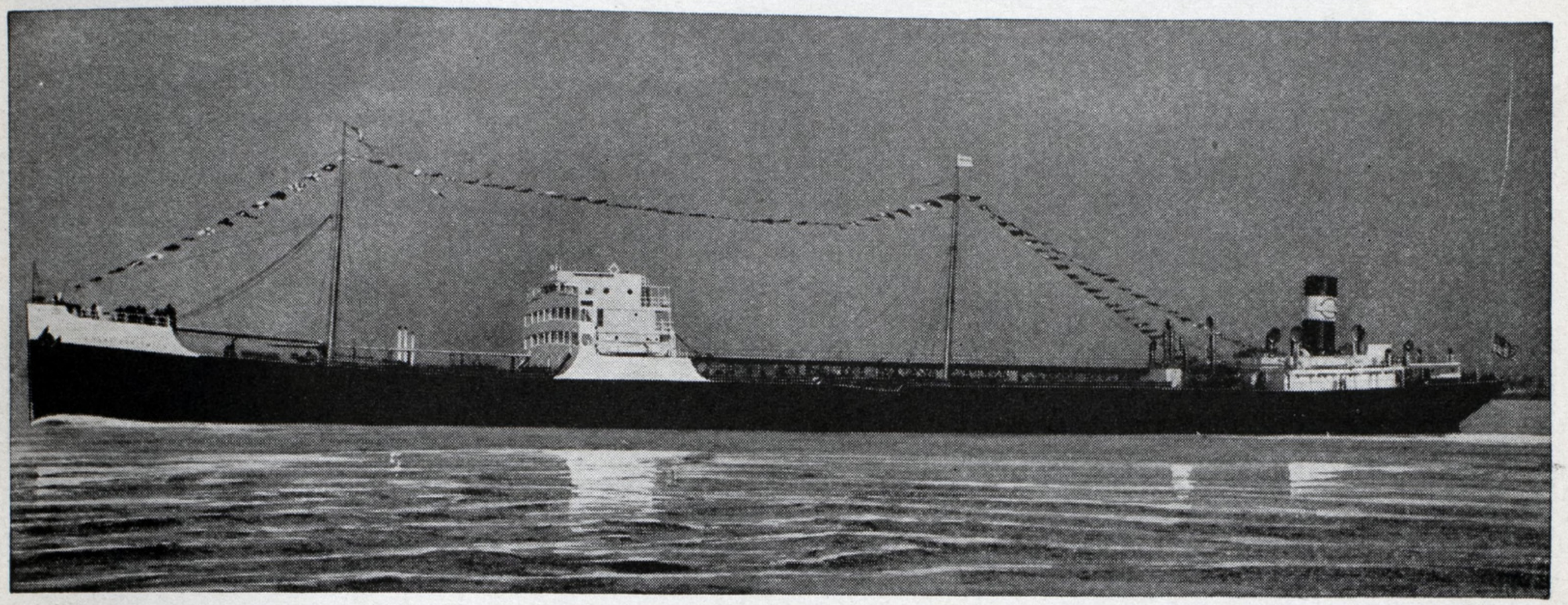
The United States Navy is a Cory customer of eighty years' standing. For lighting, signalling, and communicating equipment you, too, should buy from Cory. Write for information and prices.

CHAS. CORY CORPORATION

DIVISION OF BENDIX AVIATION CORPORATION

68-76 King Street **New York City**

Latest American built Tankers of Standard Oil Co., of New Jersey



20,000 ton tankers "G. Harrison Smith" and "W. S. Farish" built 1930, by Federal Shipbuilding and Dry Dock Company

These tankers embody the very latest improvements in steam propulsion...high efficiency geared turbines, with water tube boilers, designed for 400 lbs. pressure, 750° temperature The fuel consumption is about 0.60 lbs. per shaft horsepower hour for all purposes.

FEDERAL SHIPBUILDING AND DRY DOCK COMPANY

GENERAL OFFICES AND WORKS: LINCOLN HIGHWAY, KEARNY, NEW JERSEY

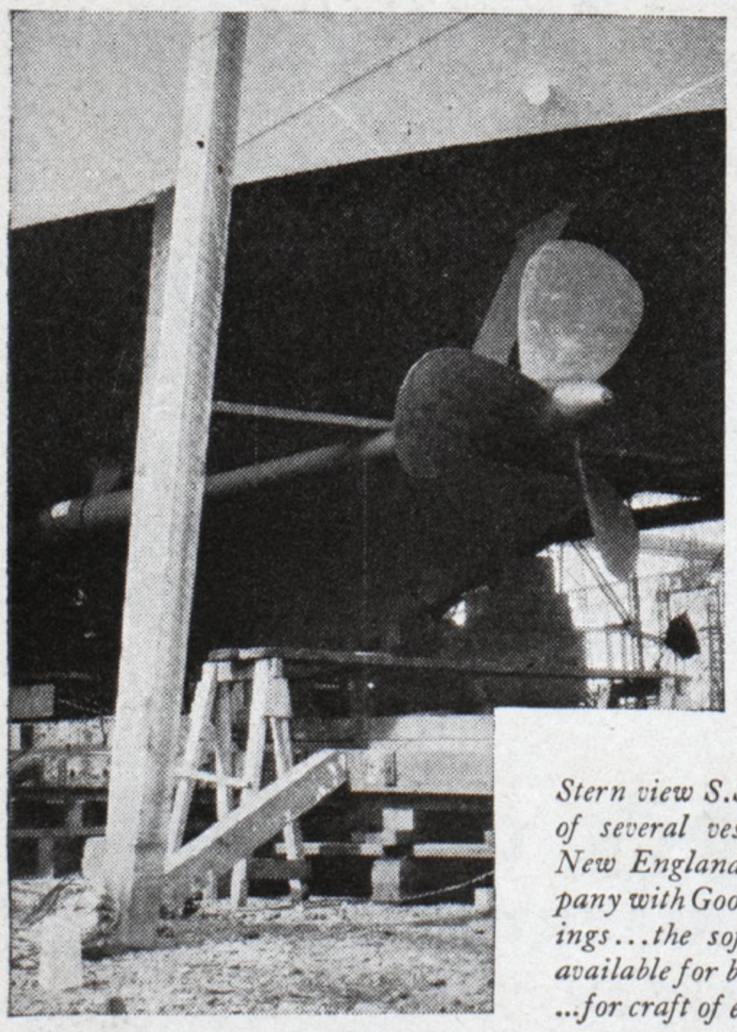
SUBSIDIARY OF UNITED STATES STEEL CORPORATION

Propeller Shaft pounding...?

The Goodrich Cutless bearing consists of a metal sleeve, lined with rubber, grooved longitudinally for the passage of the lubricating water. Radically new in principle, this Soft Rubber bearing outlasts all other types, frequently by ten to one. And all through its long life it protects the driving shaft from sand scoring.

Investigate the economies in upkeep effected by this

soft rubber



Stern view S.S. "Naushon" one of several vessels equipped by New England Steamship Company with Goodrich Cutless bearings...the soft rubber bearings available for both strut and stern ...for craft of every size and type.

AS the tugs cast off, and her propellers take hold, do you hear an ominous rumble? As she picks up speed, does the vibration grow into a steady pounding? You're aboard a craft that will soon be headed for drydock. Bearings cut...shafts scored... heavy repair bills just ahead!

If the craft is yours, you can end these untimely bearing renewals... you can make the next job of shaft relining, the last one for a long time.

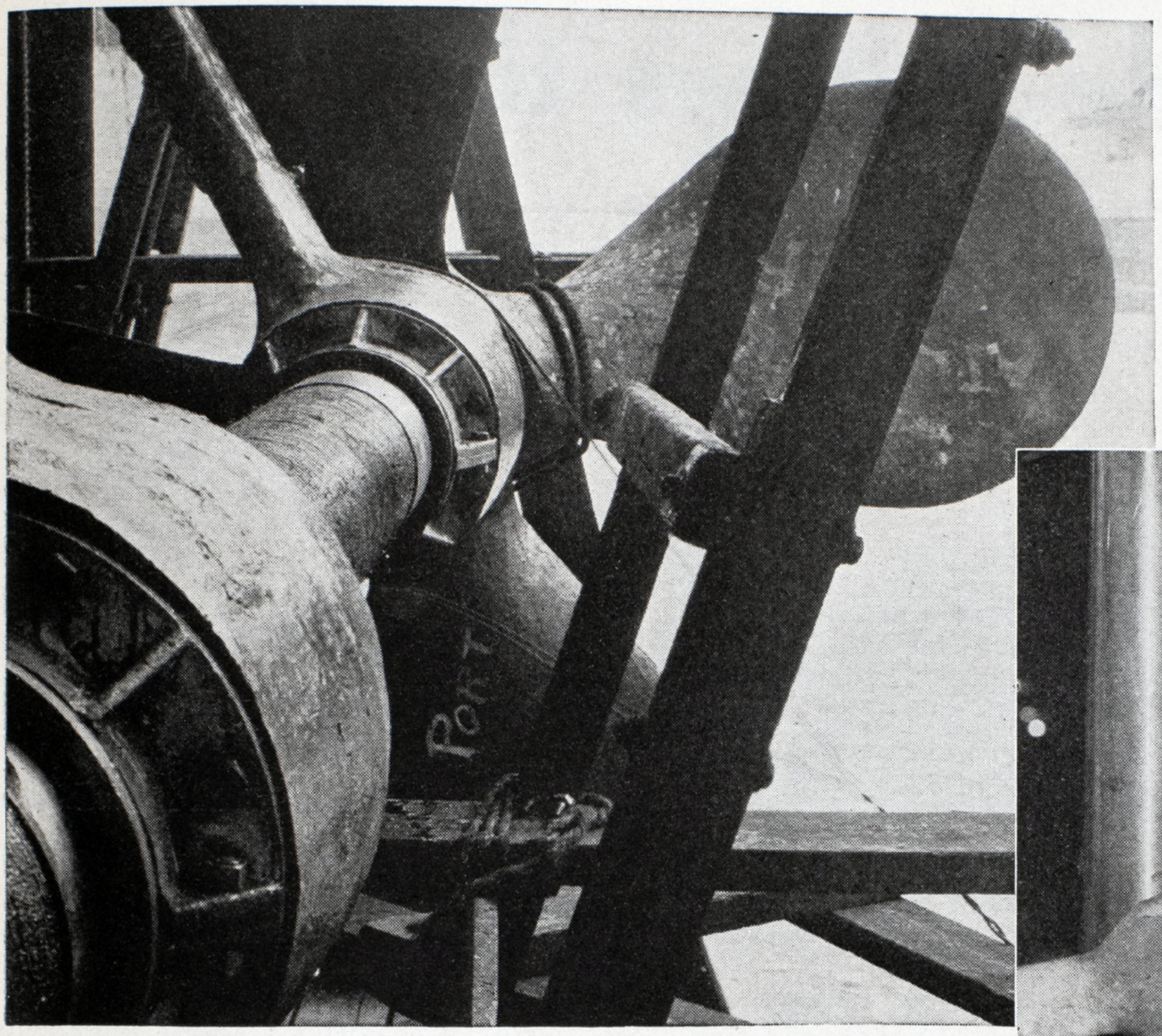
Adopt this new bearing of Soft Rubber that long outlasts hard-surfaced bearings—often, indeed, by as much as ten to one.

Sound in principle

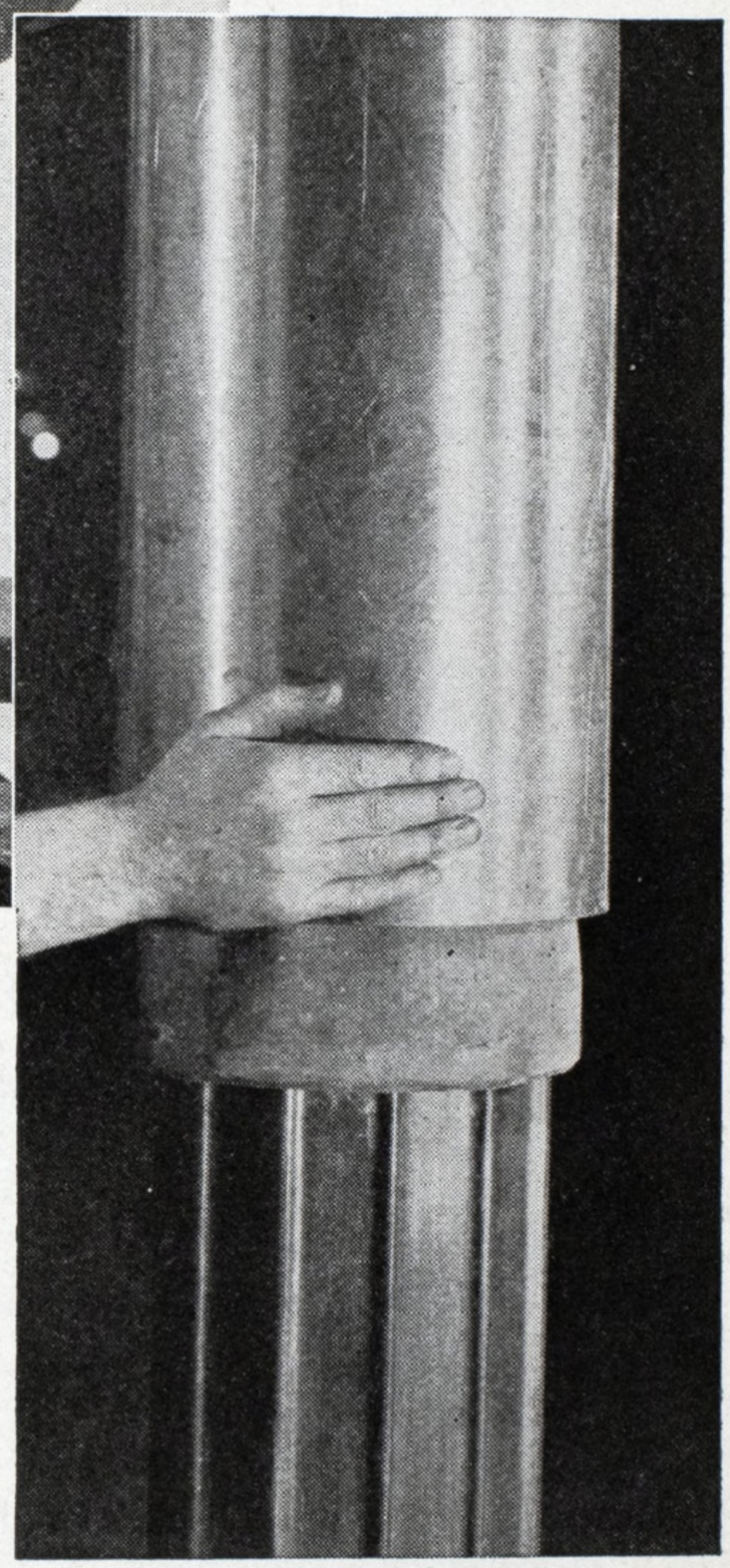
Rubber sturdily resists wear. As a tire tread it stands up under terrific strain, while metal skid chains are ground through in a few hundred miles.

Goodrich

Repair Bills mounting . . ?



View of port shaft, struts and propeller of a large seagoing hopper dredge. Goodrich Cutless bearings are used in both struts. Shaft liners are of Monel Metal. This dredge is also equipped with Goodrich Cutless rudder pintle bearings.



bearing

Rubber when wet and in contact with metal has an extremely low coefficient of friction. Witness the skidding of the rubber tire on a wet street car track.

Successful in practice

Cushioned in this Soft Rubber bearing, lubricated only by water, the metal driving shaft spins smoothly, quietly. Friction, wear, are reduced to an absolute minimum.

Sand, grit can not lodge in this Soft Rubber bearing. They are depressed into the rubber, rolled into special grooves, and ejected by the lubricating water with no cutting of the bearing, nor scoring of the shaft.

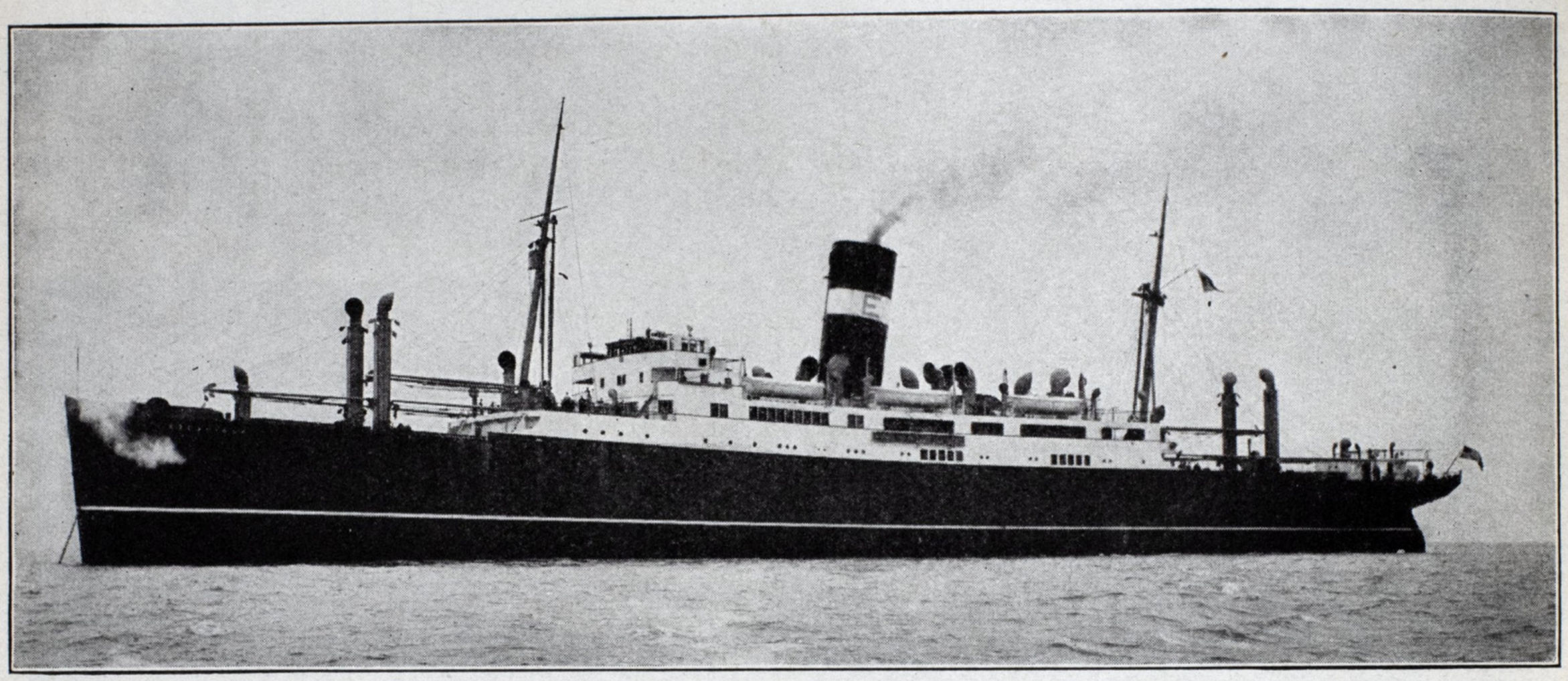
Write for catalog 531-C, to The B. F. Goodrich Rubber Company, (Est. 1870), Akron, Ohio.

Goodrich Cutless bearing in course of manufacture. Note the Soft Rubber lining, in its metal housing, being forced down on the mandrel which effects the accurate grooving indicated by the pencil in the picture at the left.

Cutless Bearings

Another B. F. Goodrich Product

Trade follows the flag



Passenger-cargo steamer "Excalibur". The first of four sister ships to be delivered to the Export Steamship Corporation for service between New York Mediterranean and Black Sea ports.

A FOREIGN flag ship was never a salesman for American goods. Where the American flag goes, there are trade-distributing, trade-gathering agencies which mean the perpetuation and expansion of American commerce.

Give America a fair share of the $750,000,000 which this country pays each year to the foreign flag ship and we shall see our trade expand, we shall see new contacts made with all the world, we shall see the lost heritage that was once America's restored to us.

Ship and Travel on American Ships

NEW YORK SHIPBUILDING COMPANY

Main Office and Works:
CAMDEN, N. J.

New York Office:
420 LEXINGTON AVE.

What the Gyro-Compass *means* . . .

to the Ship Owner

An opportunity—at a relatively small investment—to modernize his ENTIRE fleet, so that even his older vessels will be equal to the new in navigating efficiency.

to the Captain

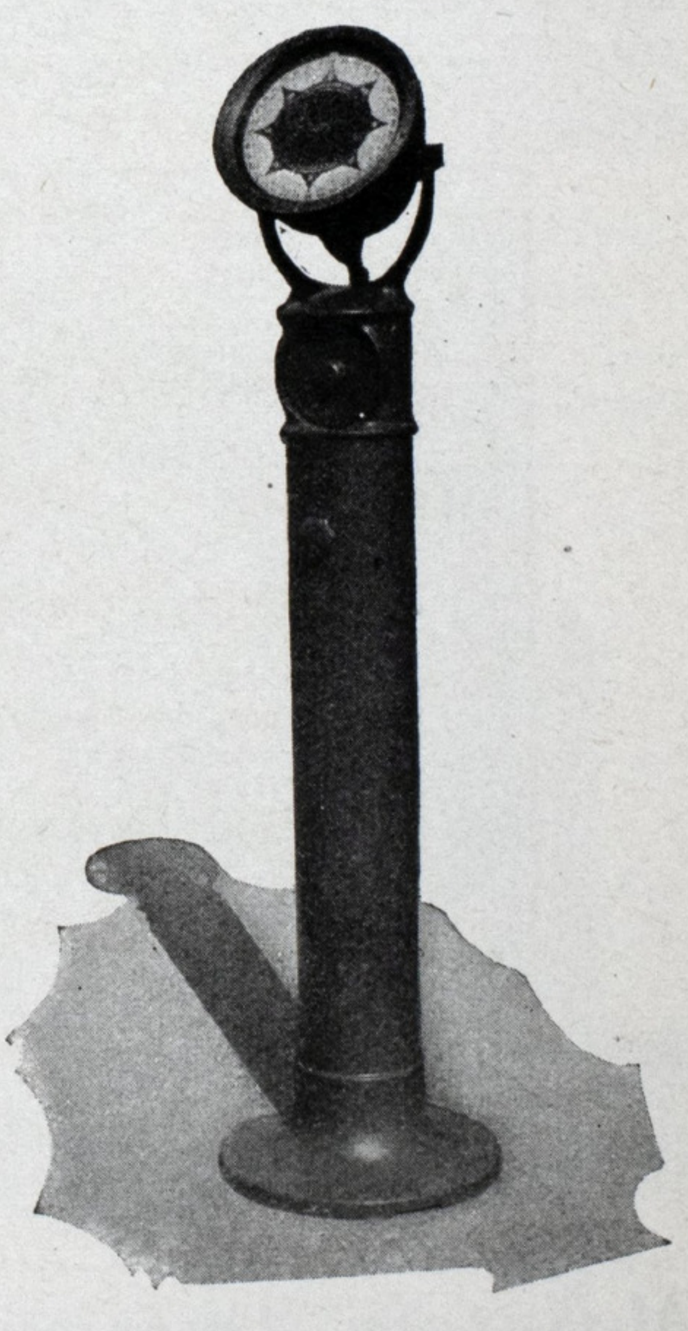
Because it is dependable, facilitates navigation, and means straighter, truer courses, the Captain regards his Gyro-Compass as an indispensable part of the vessel's navigating equipment.

to the Passenger

Every traveller has a right to expect his ship to be equipped with modern and approved aids to navigation, thus assuring a safe and expeditious passage.

to the Merchant

Assurance that his valuable cargo, carried on vessels where no phase of navigation is left to chance, will reach its destination in safety and on schedule time.



SPERRY GYROSCOPE CO., INC.

Brooklyn — New York

CLEVELAND
414 Rockefeller Bldg.

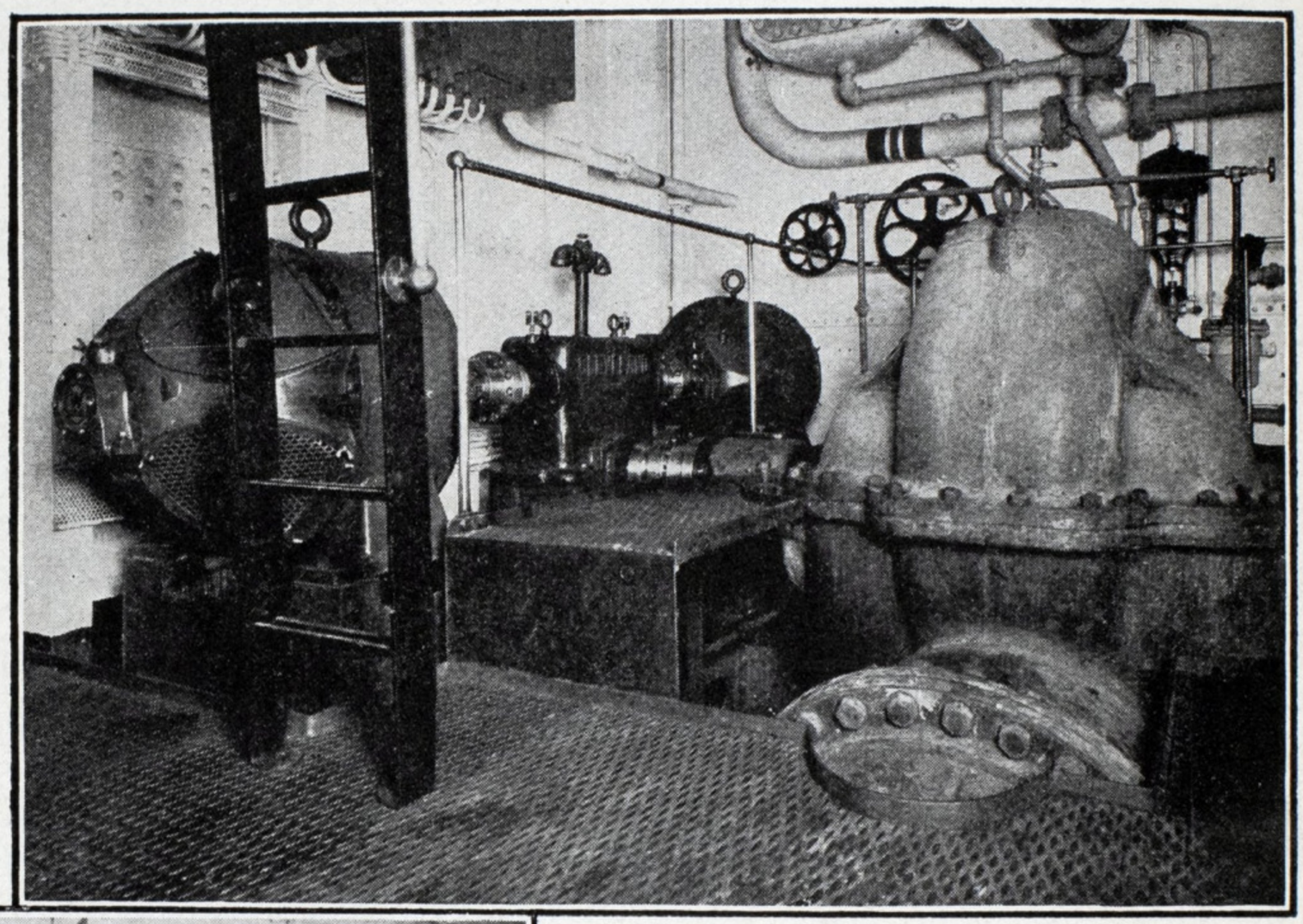
LOS ANGELES
524 Avalon Blvd., Wilmington

SAN FRANCISCO
58 Main Street

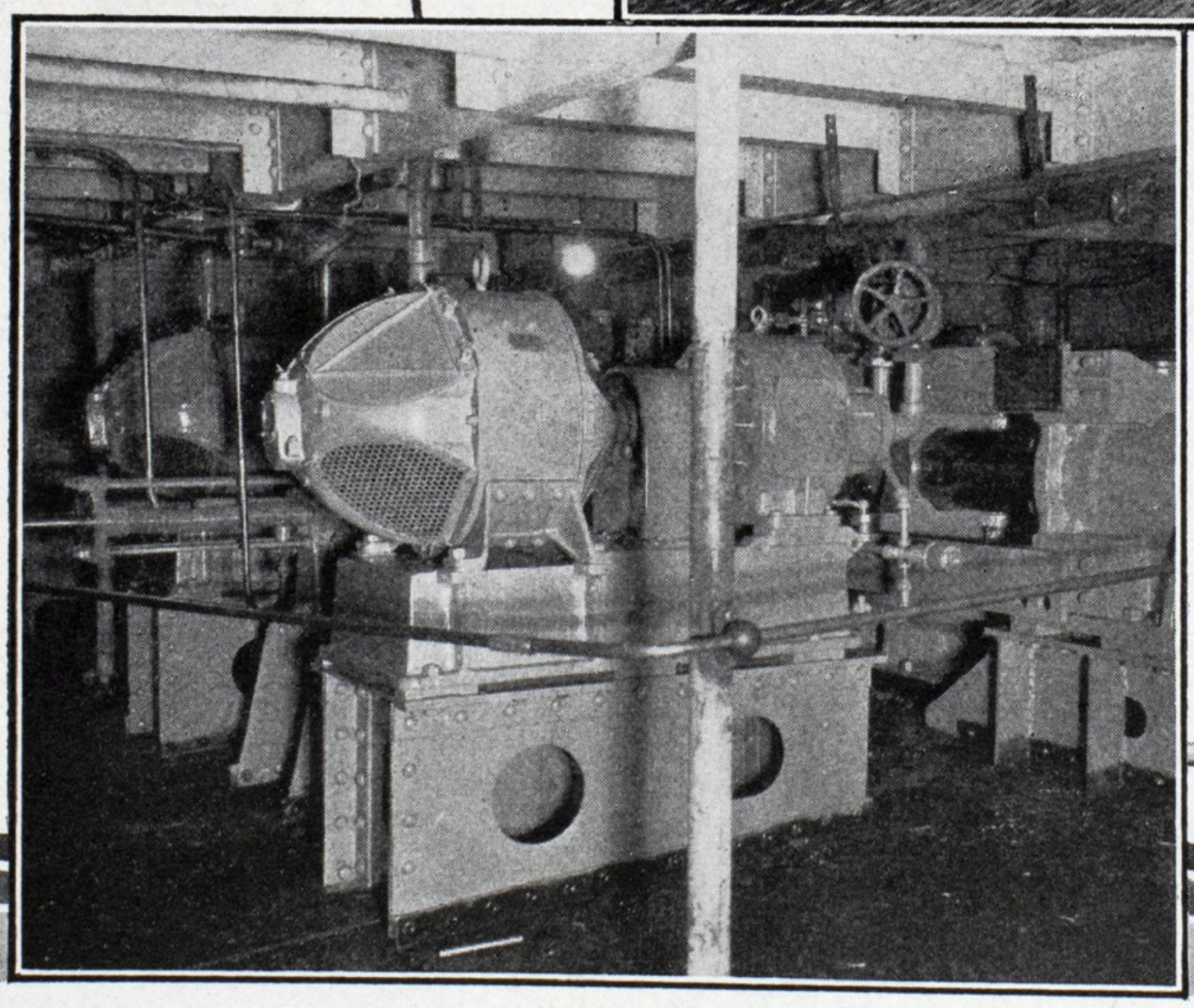
SEATTLE
2737 1st Avenue, South

MAINTAINING A PROGRESSIVE RECORD

MOTORS that



Right—Main circulating water pump of the new Export Line steamship Excalibur, powered by a Westinghouse Dual Motor Drive. These motors are of 50 hp. each and are of the drip-proof, semi-enclosed, self-ventilated type, designed especially for marine service and principally used for underdeck auxiliaries. They provide complete protection of the electrical parts from moisture and dripping water.



Left—Electrified steering gear of the Texas Company 17,000-ton tanker "Australia", powered by two Westinghouse Drip-proof Motors. All field coils and armature windings of these motors are treated with moisture resisting compound and all parts subject to rust are sherardized. The enviable records established in marine circles by Westinghouse Drip-proof Motors are due to the careful attention to details in their design and construction.

Maintain American Shipping by Patronizing American Ships

Westinghouse

T 31796

TUNE IN THE WESTINGHOUSE PROGRAM OVER KDKA, KYW, WBZ AND ASSOCIATED N. B. C. STATIONS SUNDAY EVENINGS.

always "SHIP OVER"

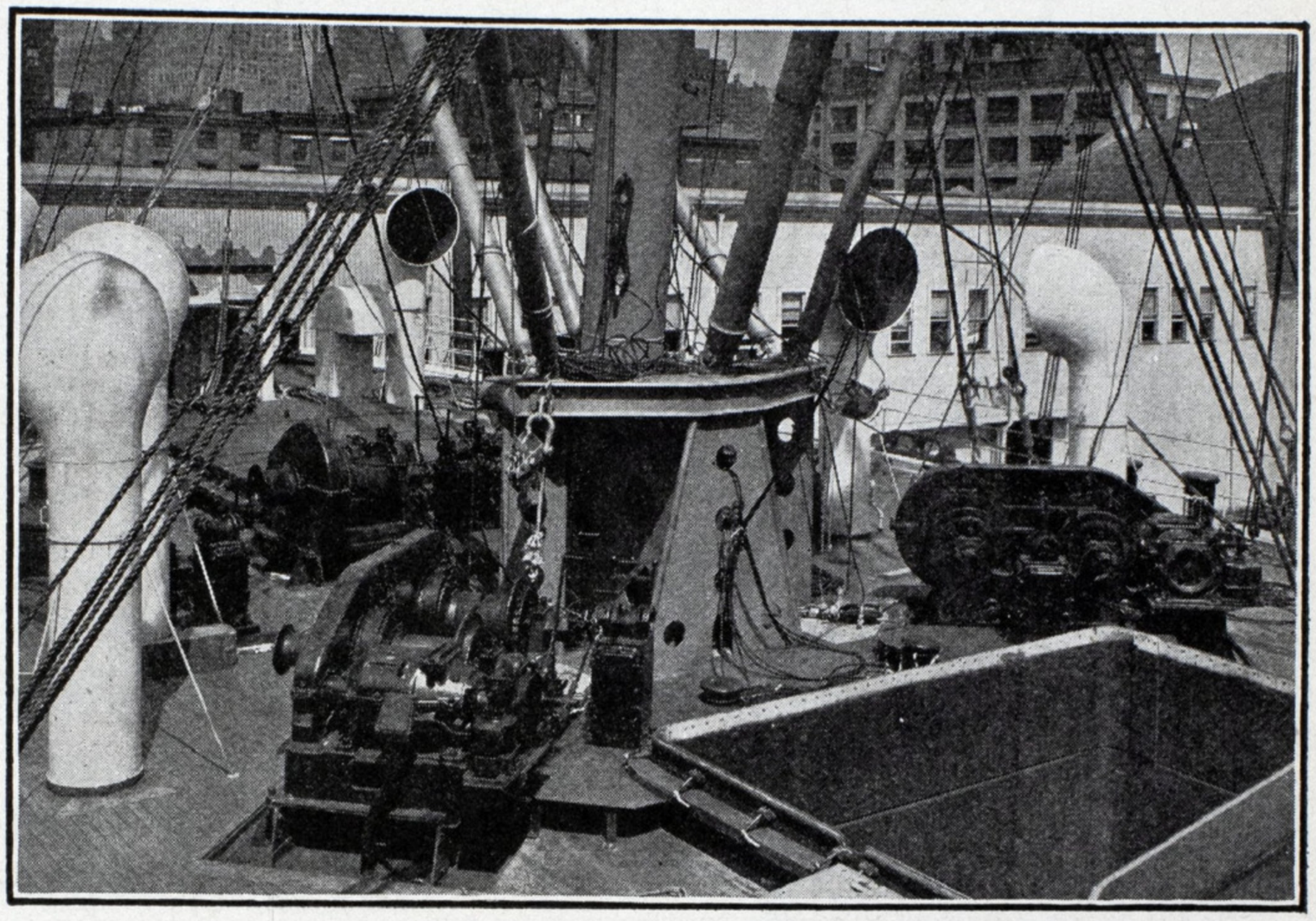
VOYAGE after voyage, year after year, on the fo'cas'le or below decks, Westinghouse motors and control, powering the auxiliary machinery of many ships in our merchant fleet, are "shipping over" with "good conduct" records.

Driving winches, steering gear, pumps, compressors, and the many auxiliaries necessary to a ship's operation at sea or in port, these permanent members of the ship's company are serving faithfully, dependably, and economically.

Back of these Westinghouse motors that are finding ever-increasing favor with marine men for auxiliary machinery drive, are years of study and research. For a score of years Westinghouse marine engineers have worked closely with those of the marine industry in seeking higher standards of performance and economy in the application of auxiliary power on board ship.

Among outstanding contributions by Westinghouse in this field is the high-speed motor with control for cargo winches, which has eliminated the slow speed of light hook lowering. Compared with electrified winches previously installed, this new equipment speeds up about 15 per cent the handling of package freight and makes it possible to move heavy loads as fast as they can be stowed in the hold.

Illustrated on these pages are views of typical Westinghouse auxiliary electric motor drives above decks and below.



Electrified Cargo Winches of the new Ward Liner Morro Castle, equipped with Westinghouse 25 and 35-hp. Waterproof Motors and Waterproof Cam Type Control. Westinghouse Waterproof Motors for deck machinery are the most rugged type built—especially designed for hard usage in port and heavy weather at sea. They are noted for their reliability, quick starting and stopping, water-tightness, low maintenance and long service.

CONTRIBUTIONS

* * * *

Geared Turbine Drive

Turbine Electric Drive

Diesel Electric Drive

Low Pressure Turbine Geared to Reciprocating Engine (Special Design)

Underneath Condenser

Improved Steam Jet Air Ejector

Improved Scoop Circulator

Propeller Type Pump

Propeller Type Blower

High Speed Cargo Winch Motor and Control

THE
Great Lakes Red Book
FOR 1931

The Most Widely Used and Best Known Directory on the Great Lakes—

IT IS a complete list of vessels plying the Great Lakes, with the names of the owner, captain and engineer of each vessel.

Contains a separate list of the ore carriers, showing the capacity of each, and a list of the supply houses, fuel docks, repair men, etc., at each port.

The
Great Lakes
RED BOOK
1931
A list of over 1200 Vessels of the Great Lakes, together with the name of Owner, Captain and Engineer of each Vessel, Shipbuilding and Repair Yards
Published by
MARINE REVIEW
CLEVELAND
PRICE - - - - $1.00
½ Actual Size

It also includes an accurate and complete directory of ship building and ship repair yards serving shipping on the Great Lakes. The officers as well as the building and repair facilities of these yards are listed.

Because of its convenient vest-pocket size, *The Great Lakes Red Book* is depended upon by vesselmen and others interested in *Great Lakes* trade, as the most complete, reliable and convenient directory of its kind.

To be sure of getting a 1931 book—

MAIL THIS COUPON NOW!

THE PENTON PUBLISHING CO.
Book Department
1213-35 W. 3rd St., Cleveland, O.

Date.....

Enclosed is $.....for which you are to send, postage prepaid,.....copies of The Great Lakes Red Book for 1931.

Price
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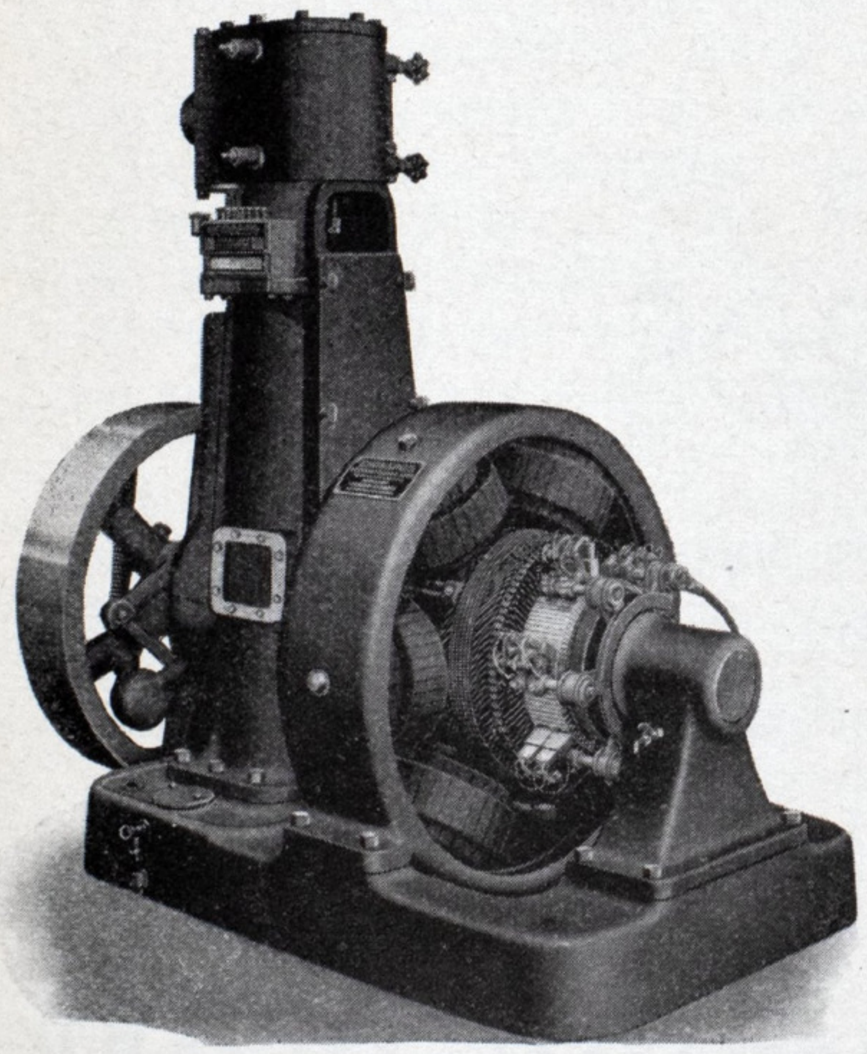
164 M.—165-M.

NEW GRAND TRUNK FERRY

Equipped with Engberg Generating Sets.

NEW CARFERRY, CITY OF MILWAUKEE, built by Manitowoc Shipbuilding Corporation for Grand Trunk Railway and equipped with 2 Engberg 20 Kw. Improved Marine Generating Sets.

Steam Engine Generating Sets Selected for Their Reliability and Economy.



SEASON after season low cost, dependable operation in other vessels of the Grand Trunk fleet was responsible for the selection of Engberg steam engine generating sets in this new vessel. Their reliability, low maintenance, and low maintained steam consumption were definitely proved by actual performance and were considered better than that offered by any other type or make of equipment.

You will find those marine concerns who are holding costs to a minimum, whether located on river, lake or ocean, consistently specify and install Engberg Generating Sets. They know these units will cut costs and keep costs down.

Send for Bulletin No. 1901. This fully describes and illustrates the units and will be sent without obligation.

TROY ENGINE & MACHINE COMPANY

2244 Railroad Avenue » Troy, Pennsylvania

Manufacturers of

VERTICAL AND HORIZONTAL STEAM ENGINES » GENERATING SETS
GENERATORS » SWITCHBOARDS

TROY - ENGBERG

MARINE GENERATING SETS AND ENGINES

Pay for themselves by low cost dependable operation

M-31-4

Machine shop at Rivard Street, Detroit where we build and repair engines

HIGHEST STANDARDS

of workmanship, engineering and service are ever apparent in Great Lakes built ships and engines—and repairs.

GREAT LAKES ENGINEERING WORKS

Shipbuilders and Engineers

General Offices

River Rouge, Michigan

Cleveland Office: Union Trust Bldg.

Engine Works Equipped For General Heavy Machine and Foundry Work

Detroit, Michigan

Complete Shipbuilding Dry Dock and Repair Facilities

River Rouge, Mich., and Ashtabula, Ohio

Clark "Tilt Truck"—Gas-powered for 24 hours continuous service.

Clark "Tilt Truck" Lifts—Tilts—Carries

Here's the new Clark "Tilt Truck"—a powerful, ambitious machine that slips giant fingers under a 2640-lb. load, raises it, tilts it 50 deg. and makes off with it. A hungry, grasping, champing brute, eager for work and powered for gruelling performance. Gets hold of and gets away with cumbersome freight loads.

It handles the bulky, ponderous, hard-to-get-hold-of loads. Large axle with differential, 7″ driving wheel tires, 5″ steering wheel tires. One lever controls lifting and tilting operations. Automatic stop limits lift position. Give this truck the heavy cargo—use your common labor elsewhere.

Write for complete details of construction and performance, *mentioning this advertisement.*

Special Note!

Clark vehicles are gas-powered—therefore competent for 24 hour continuous service and just as potent the last hour as the first.

Clark 24-hr. continuous service

Ordinary 8-hr. service

The Clark Tructractor Co.
Battle Creek, Mich.

Attach this ADVERTISEMENT to your inquiry

EASY HANDLING

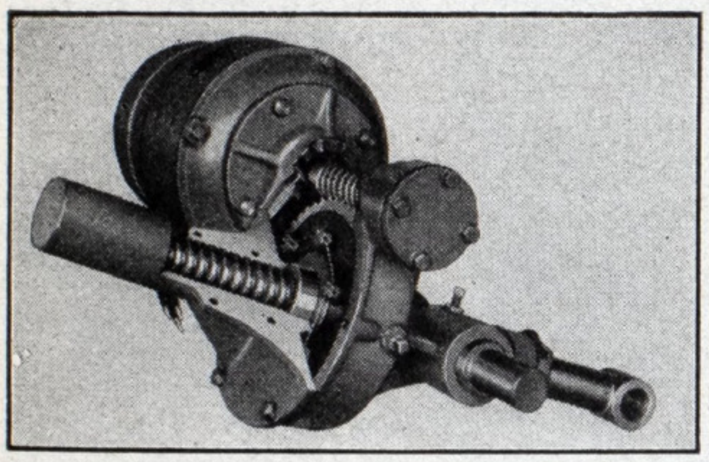
that gives speedy operation . . . . .

ABUNDANT, continuous motor power, easy steering and quick acting brakes give the operator of an Elwell-Parker Electric truck complete and instant control over every movement . . . forward . . . backward . . . or raising or lowering a load.

Brakes can be applied with the power on, so that stopping and starting on ramps is easy and safe. Because the starting and reverse handles return to neutral and brake is automatically applied if operator lifts his foot, or if he steps off pedals, the truck *stays* where *stopped.*

Safe and easy steering by wheel or by horizontal steering lever is accomplished with least effort because wheels pivot over center of tires. Every modern Elwell-Parker truck may be operated with equal ease, when operator either faces the load or stands with back to the load in an alert, comfortable position.

On lift trucks, the platform travel may be arrested manually at any desired point or stops may be adjusted to suit lesser lifts. An overload slip clutch protects the lift mechanism should the platform be thrust beneath an immovable object.



Cutaway view of Elwell-Parker lift unit—this unit contains a brake that is mechanically applied when lift motor is at rest. There are but three moving parts in this lift unit.

You'll appreciate many times over these easy handling as well as safety advantages after you purchase an electric truck. To be sure you get them all specify "Elwell-Parker."

Write for this new booklet, "Handling and Shipping on Skids" that explains with over 75 photographs how scores of operators are increasing profits by handling materials on skid platforms with Elwell-Parker Trucks. For a copy write The Elwell-Parker Electric Company, 4200 St. Clair Ave., Cleveland, Ohio.

ELWELL-PARKER

DESIGNERS AND BUILDERS OF ELECTRIC INDUSTRIAL TRUCKS, TRACTORS AND CRANES FOR OVER A QUARTER CENTURY

SAVE DOLLARS

with fast material-handling

It's the every-day performance of electric industrial trucks, equipped with Exide-Ironclads, that proves their economy

HERE'S one way to reduce production costs in your plant. Use electric industrial trucks powered by Exide-Ironclad Batteries, for all material-handling jobs possible.

Many large concerns throughout the United States have already proved that they save actual dollars this way. They have found that electric trucks move material speedily, easily, and with economy. And give dependable, low-cost operation when powered by Exide-Ironclad Batteries.

It's the decidedly different construction of the Exide-Ironclad Battery that makes it give such reliable service with minimum care and attention . . . have such a long life . . . save owner's money.

Investigate the many dollar-saving advantages of having Exide-Ironclads do your handling jobs. Write for Bulletin, "Adaptability of Electric Industrial Trucks and Tractors." No obligation.

Exide-Ironclad cell cut away to show its money-saving construction.

IT'S EASY, economical and fast... handling material with electric industrial trucks powered by Exide-Ironclad Batteries. Ask those who use them. One Exide-Ironclad Battery, one truck and one man, saved one firm $7,000 in a 14-day period. (Confirming letter in our file.)

Exide
IRONCLAD
BATTERIES

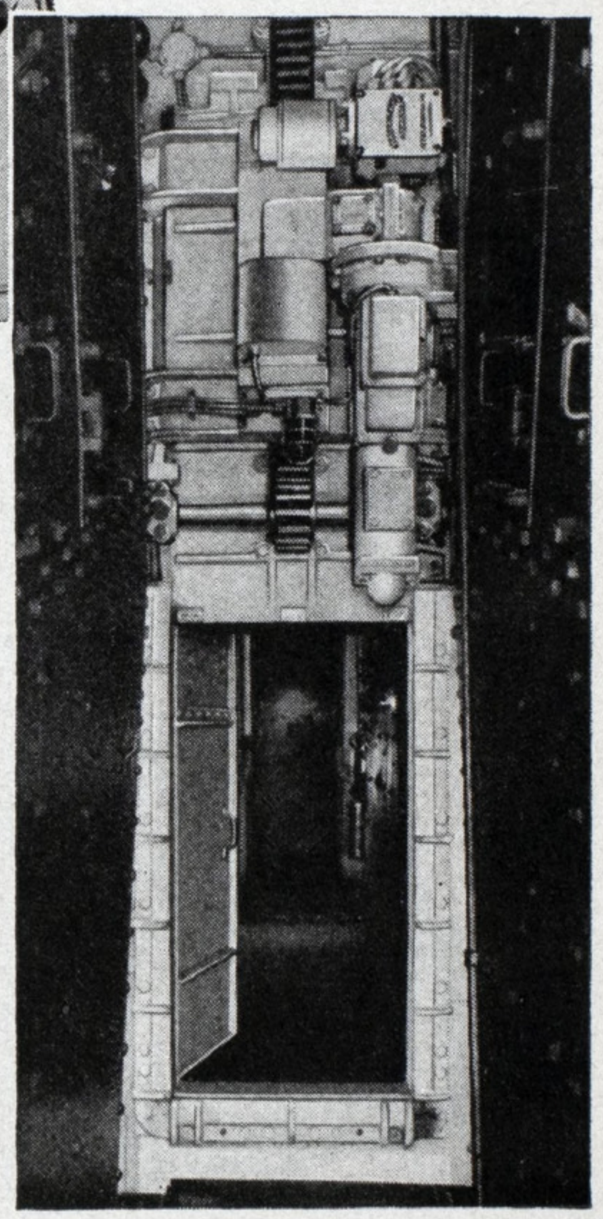
THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia

THE WORLD'S LARGEST MANUFACTURERS OF STORAGE BATTERIES FOR EVERY PURPOSE

Exide Batteries of Canada, Limited, Toronto

Meets all requirements of The International Conference on Safety of Life at Sea.

Lights on the master control panel board flash the position of each bulkhead door—open, closing or shut—to the officer in the pilot house. Below is a view of a Bulkhead Door Control Unit installed on board the S. S. California of the Panama-Pacific S. S. Co.



Like a "Bulkhead Watch" *that never goes* Off Duty

Be certain your motor control is built for sea service

Rough weather . . . the roll and pitch of the vessel—sleet, rain and salt atmosphere—all these trying conditions of service can only be met by motor control built for the sea. *The standard line of Cutler-Hammer* Marine *Motor Control is the result of three decades of shipboard experience—building control especially for marine uses. All ordinary requirements are met by the standard C-H line. Write for full information.*

WHEN your bulkhead doors are under the alert, responsive control of Cutler-Hammer Bulkhead Door Operating System you have a "bulkhead watch" that never goes off duty. Day and night a high starting torque motor stands guard at each opening, ready—at the flip of a switch in the pilot house—to close or open the door *within seconds.* Far faster than by hand. And far more safely. For the C-H System operates all doors simultaneously . . . or separately, if required. You can isolate an entire section of the ship as quickly as you can close a single door.

The C-H Motor-Driven System is simple. There is a master control panel located in the pilot house which has constant control of every door. At each opening there are two local control stations. These operate independently of the master control. But . . . and this is important . . . *manual or local operation of bulkhead doors is never interfered with.* The C-H System is *fool-proof.*

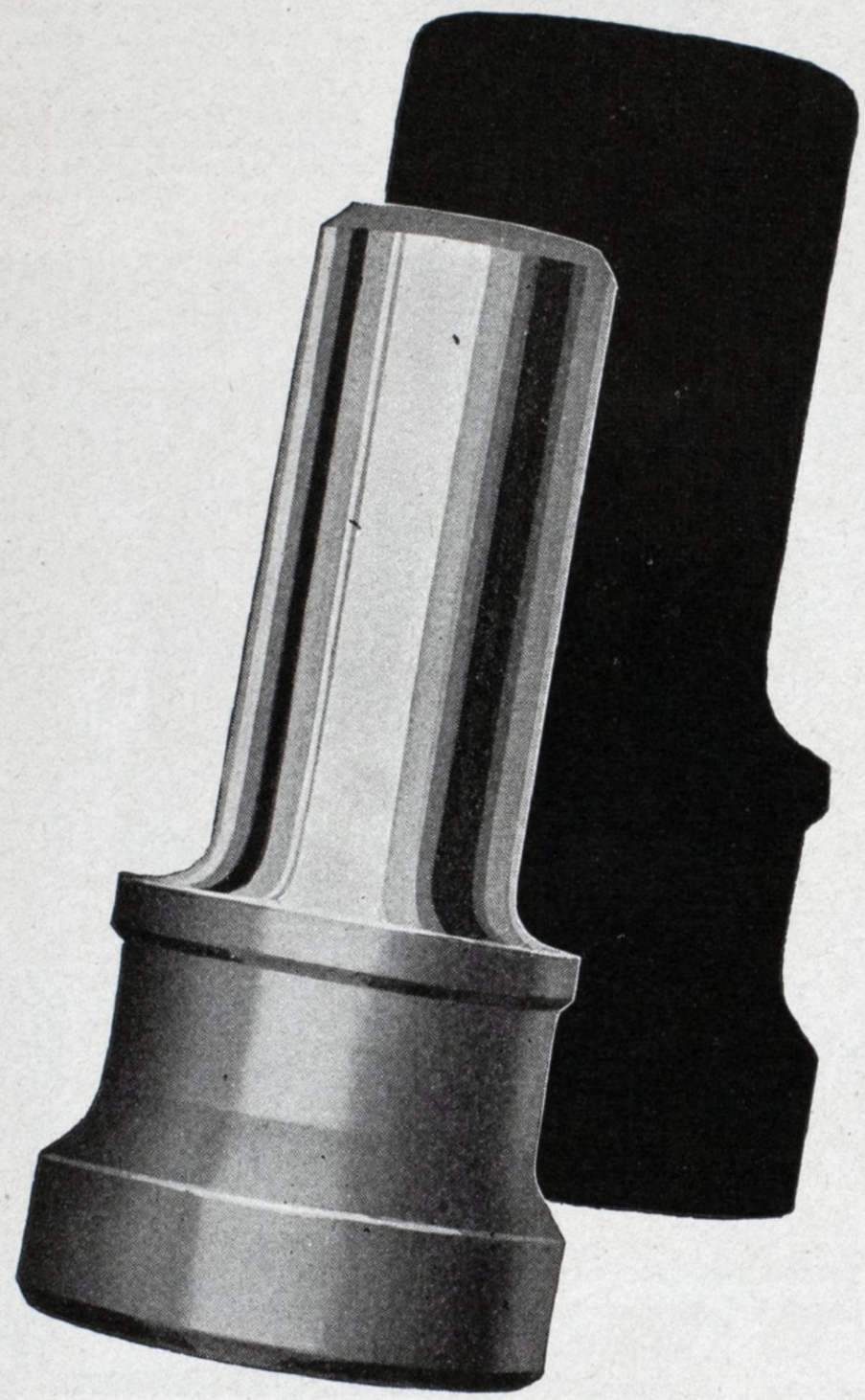
Naval architects and shipbuilders cooperated with Cutler-Hammer ship engineers in the design of this system . . . the first to be installed on a U. S. vessel. It goes readily into new or rebuilt ships. It meets all naval specifications. Builders of yachts, diesels and steamships should read "*Modern Watertight Door Control.*" Your copy of this new Cutler-Hammer booklet is free. CUTLER-HAMMER, Inc., *Pioneer Manufacturers of Electric Control Apparatus,* 1322 St. Paul Avenue, Milwaukee, Wisconsin.

CUTLER HAMMER

Motor-Driven Bulkhead Door Operating Systems

(A-4009)

RICH
Red Head
Rivet Sets



More Economical—
Because They Last
So Much Longer

Rich Red Head Rivet Sets can be recupped *cold*. Just turn out the burr in a lathe. Many users find they can be recupped fifteen times or more. Send for a sample, mentioning the size and shank you want. Then test a Rich Red Head against any other rivet sets you are now using.

Manufactured by

WILCOX-RICH CORP.

9771 French Road, Detroit

Yacht owners and ship owners *insist on good dry docks*

More and more the owners of yachts and ships are insisting upon good dry docks.

Crandall Railway Dry Docks are good. They are backed by seventy-five years of design and experience. Crandall Dry Docks give better service—that means better business—that means more profits for Crandall Dry Dock owners.

Literature upon request.

THE
CRANDALL ENGINEERING
COMPANY
Cambridge, Massachusetts, U.S.A.

"That's the part I want."

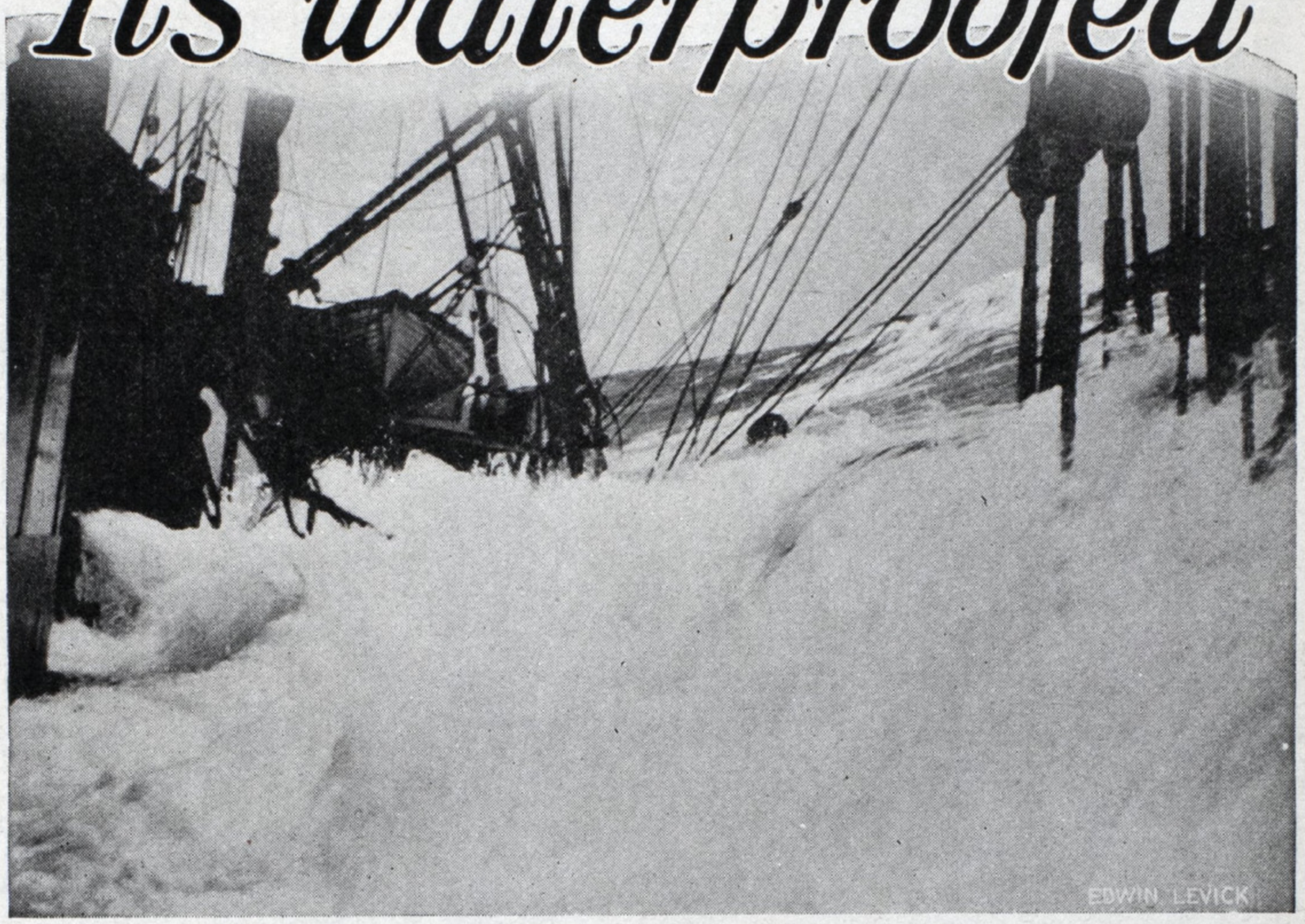
It is usually an urgent matter when repairs are needed for a galley range: delay serious inconvenience. Through its wide distribution coupled to the fact that a parts catalog is available to every SHIPMATE user, obtaining repairs for a SHIPMATE is easier, quicker and more certain than for any other range. This important fact should be given due weight when the purchase of a range is considered. If you haven't a copy of "SHIPMATE PARTS" we shall be glad to mail you one.

THE STAMFORD FOUNDRY COMPANY
STAMFORD CONN

SHIPMATE

HEAVY SEAS DO NOT INJURE COLUMBIAN

It's waterproofed



HIGH seas and old fashioned rope make a poor combination. When decks are awash, a line which is flexible when wet is the only line that can be handled satisfactorily.

Old fashioned rope is never flexible after a wetting, while Guaranteed Columbian is more flexible than any rope under these conditions. The reason is that Columbian is thoroughly waterproofed. No amount of immersion in water will injure Columbian *Tape-Marked* Rope.

There are many other reasons why Columbian has a decided preference in the marine field. It has great strength and durability. It is a perfectly balanced line. It will not kink and is rot proof. And the famous *Tape-Marker* which is found in one of the strands brings the manufacturer's personal Guarantee direct to the user.

For the most service, wet or dry, take aboard Columbian *Tape-Marked* Rope. Any Columbian line, ¾ inches or larger in diameter is instantly identified by the red, white and blue surface markers.

Columbian Rope Company
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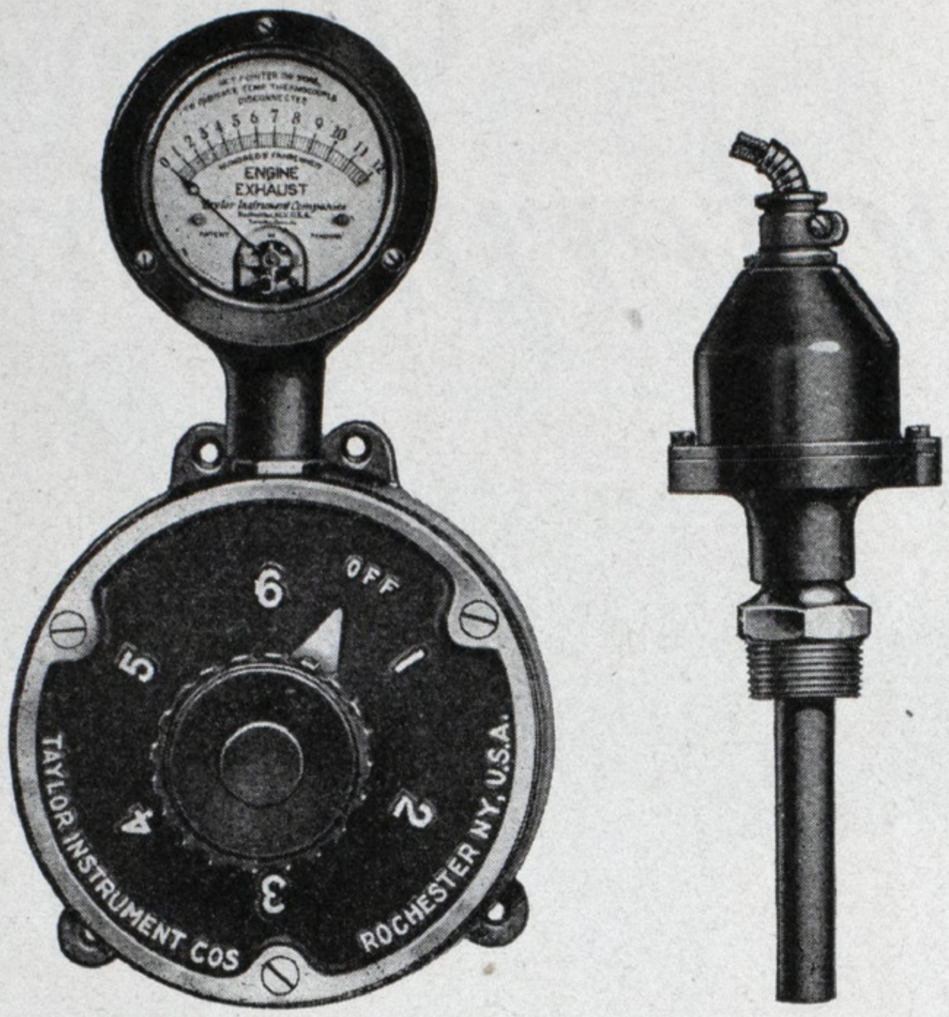
Auburn, "*The Cordage City*," N. Y.
Branches:— New York Chicago Boston New Orleans Philadelphia

COLUMBIAN TAPE-MARKED PURE MANILA ROPE

Check your Exhaust Temperatures with a *Tycos* Diesel-Engine Pyrometer



Deisel-Engine Pyrometer For Exhaust Temperatures

SHIP engineers know how important it is to have a close check on how each cylinder of the Diesel Engines is functioning. Tycos Pyrometers for Exhaust Temperatures are specially designed to stand ship conditions and give the engineer the information he wants.

A Tycos Diesel-Engine Pyrometer with a thermocouple in each exhaust port discharge line and a 6-point or 12-point switch tells at a glance how each cylinder is behaving.

The engineer has an immediate check on cylinder lubrication, cooling water circulation, combustion and valve operation. He knows if he is using too much or too little fuel oil and can check on the condition of pistons and rings.

All this is valuable information . . . information the engineer needs and that a Tycos Pyrometer will give. Our engineers will be glad to tell you more about the application.

Taylor Instrument Companies

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HAMBURG-AMERICAN LINE

PASSENGER SERVICES: New York to Cherbourg, Southampton and Hamburg. New York to Galway, Cobh (Queenstown), Cherbourg and Hamburg. North Pacific Ports to Hamburg, Bremen and Antwerp via Panama Canal.

PLEASURE CRUISES: Around the World, to the West Indies, to Northern Wonderlands.

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39 Broadway New York

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THE PARACOIL PARADE

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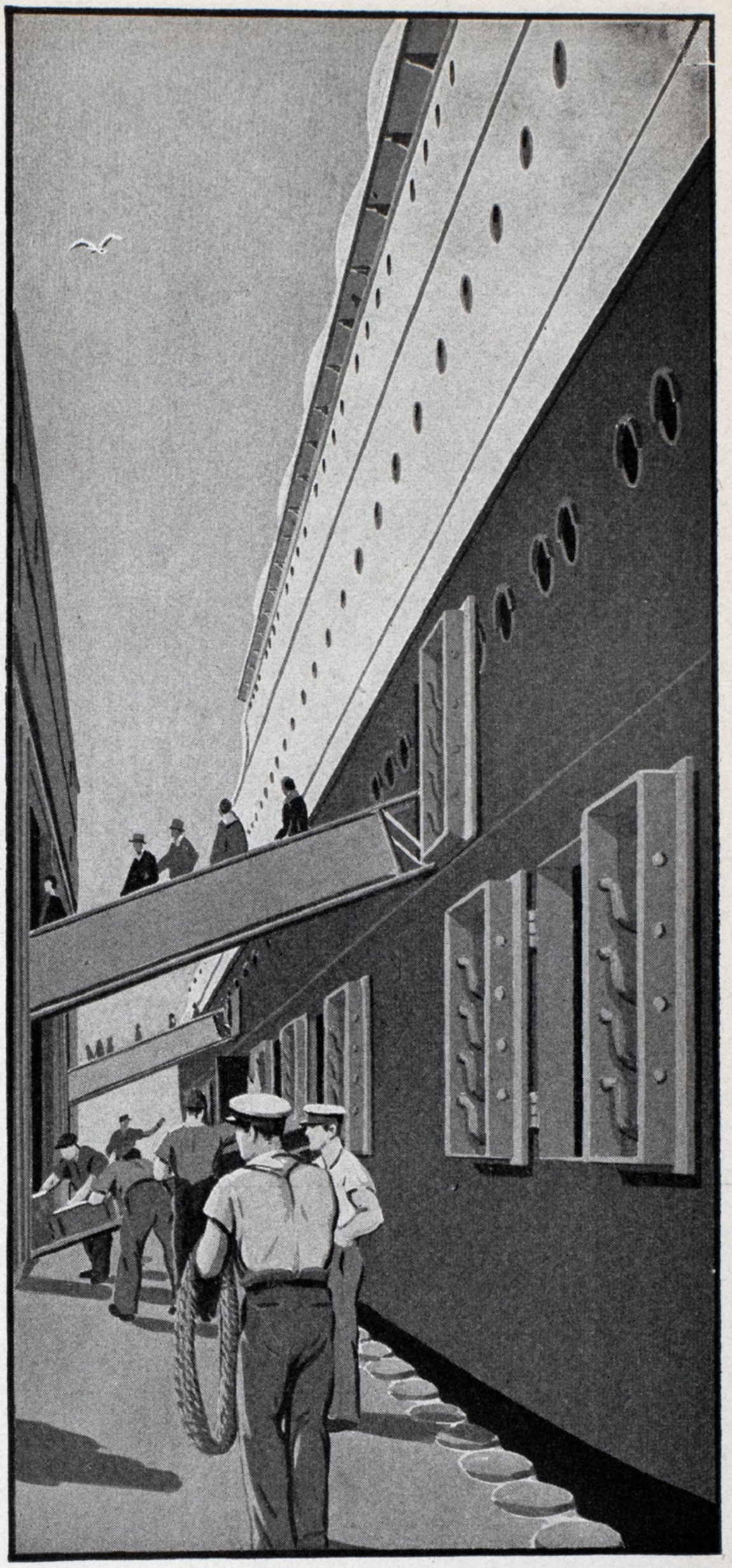
Electric ship propulsion first proved its superior qualities and economies in American waters, with American equipment—a realization of the efficiency which is the object of our electrical industry. Leading American lines have adopted electricity not only to drive the ship, but for a hundred auxiliary uses on shipboard. • This attainment of swift, vibrationless sea travel has aroused hearty response in a public preference for all-electric ships. Passage on an American-built and American-owned liner is more than appreciation of the finest luxury that the sea can afford—it also promotes national industries and institutions.

• General Electric engineers pioneered electric drive and have brought it to its present perfection. Their practical experience is at the service of all who are interested in electric marine equipment.



JOIN US IN THE GENERAL ELECTRIC PROGRAM,
BROADCAST EVERY SATURDAY EVENING ON A
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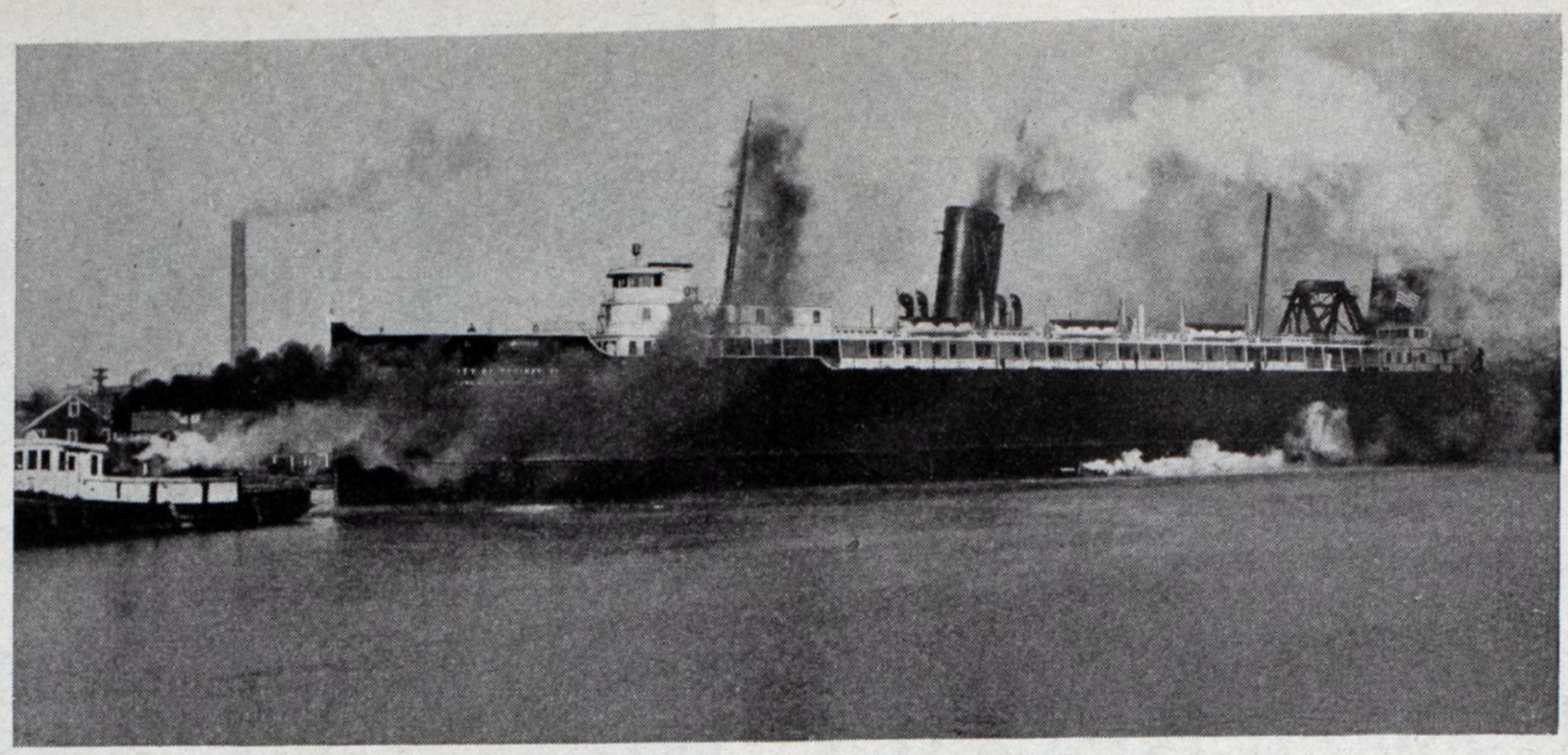
173-17

GENERAL ELECTRIC

MARINE EQUIPMENT



HERE IS THE CITY OF SAGINAW 31, the turbo electric drive carferry built by us for the Pere Marquette Railway Company. When it comes to designing and building vessels our engineering organization, skilled workmen, and modern facilities guarantee satisfaction to the customer.

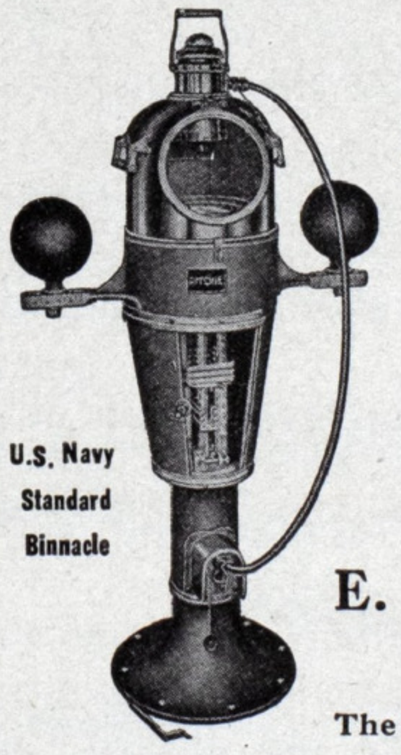
We design and build steel passenger and freight vessels, carferries, oil tankers, sand suckers, lighters, dredges, yachts, fire boats, tugs, derricks, scows, marine engines and boilers. At this plant you will find excellent facilities, including a 600′ steel floating dry dock, for ship, engine and boiler repairs.

MANITOWOC SHIPBUILDING CORPORATION
MANITOWOC, WISCONSIN

Ship For Sale?

If you have a passenger ship, freighter, tanker, tug or any other floating property or marine equipment for sale advertise it in Marine Review.

The rate is $3.00 for a minimum advertisement of 30 words. Additional words, 10c each.



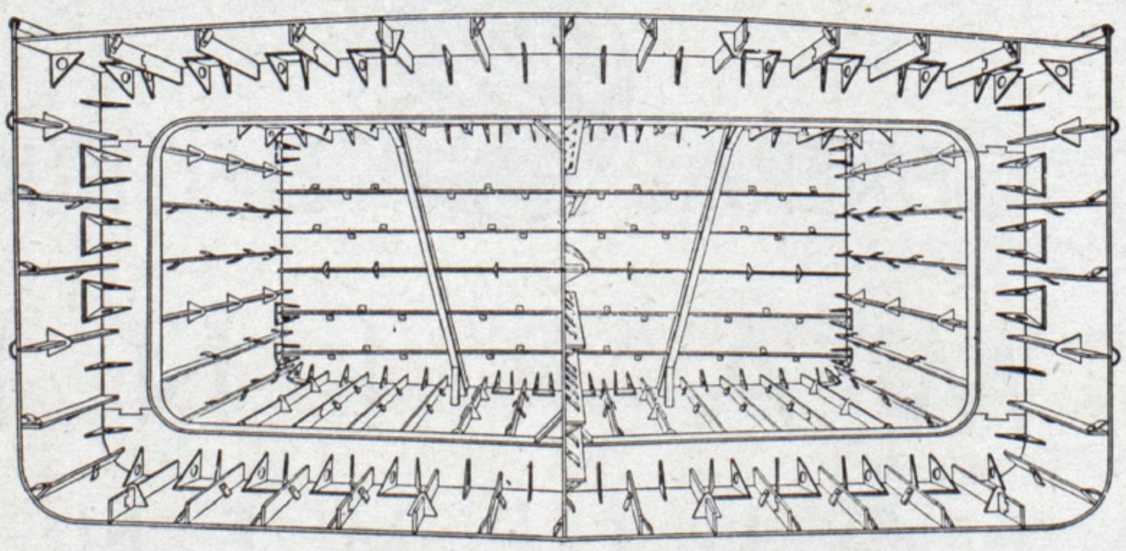
U.S. Navy Standard Binnacle

THE RITCHIE LIQUID COMPASS

The Standard Liquid Compass the world over.
Used Exclusively in U. S. Navy for over 40 years.
Over 65,000 on Merchant Vessels in all parts of the world.
Made in all sizes 2 to 12″ dia.
Magnets for adjusting Purposes.

E. S. RITCHIE & SONS
Brookline, Mass., U. S. A.
Agents for the Great Lakes,
The Upson-Walton Company, Cleveland, Ohio

Reduces Construction Costs—Increases Carrying Capacity



Midship Section of Transverse and Bulkhead

Marine Boilers—Barges—Scows—Lighters General Repairs to Wooden and Steel Vessels—Two Marine Railways

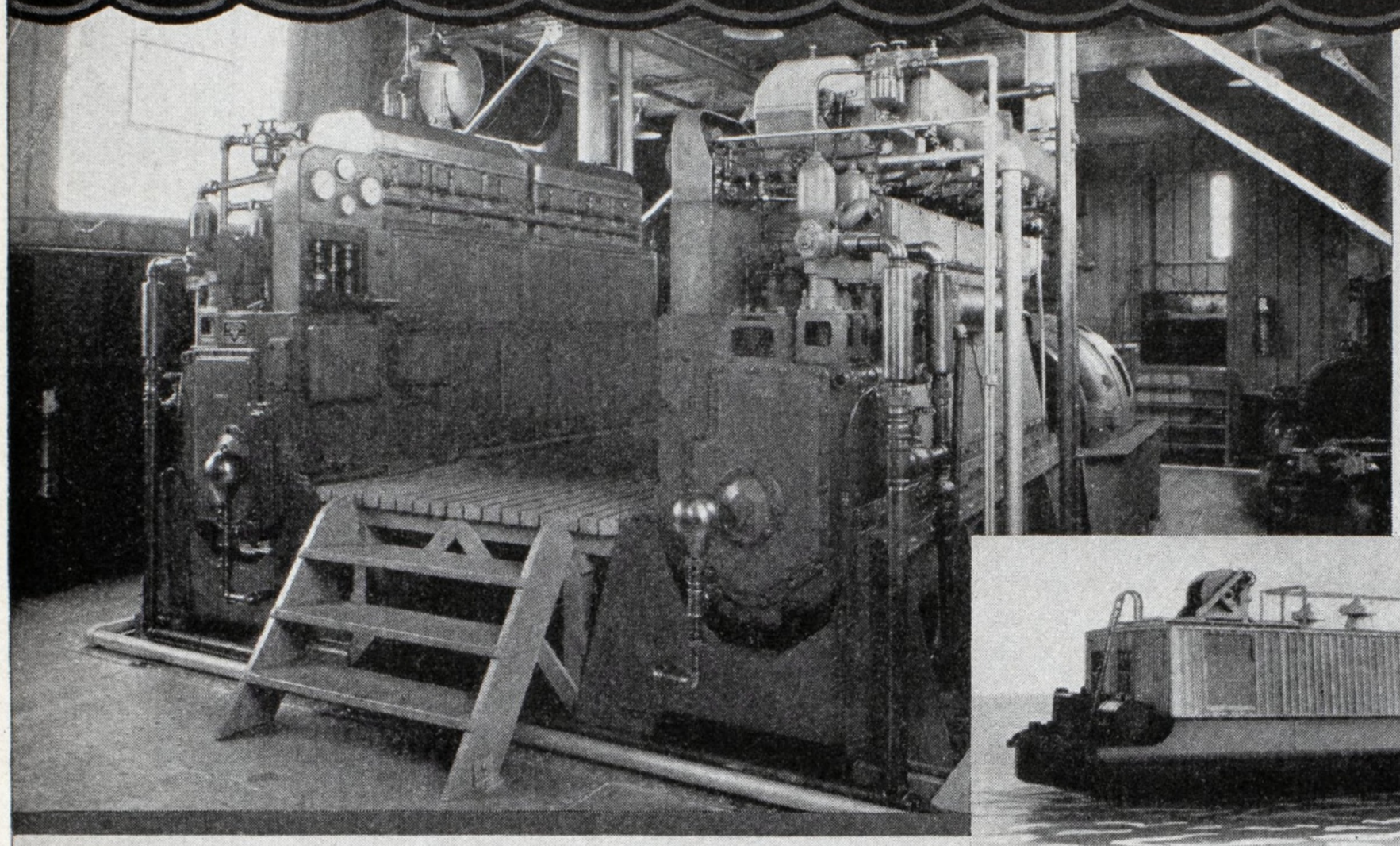
Used in All Types of Ship Construction Including Barges, River Steamers and Dredges
Does away entirely with Angles, Shapes, Rivets and Bolts.

Richard F. Smith
Patent Applied for
Lock Notch Welded System

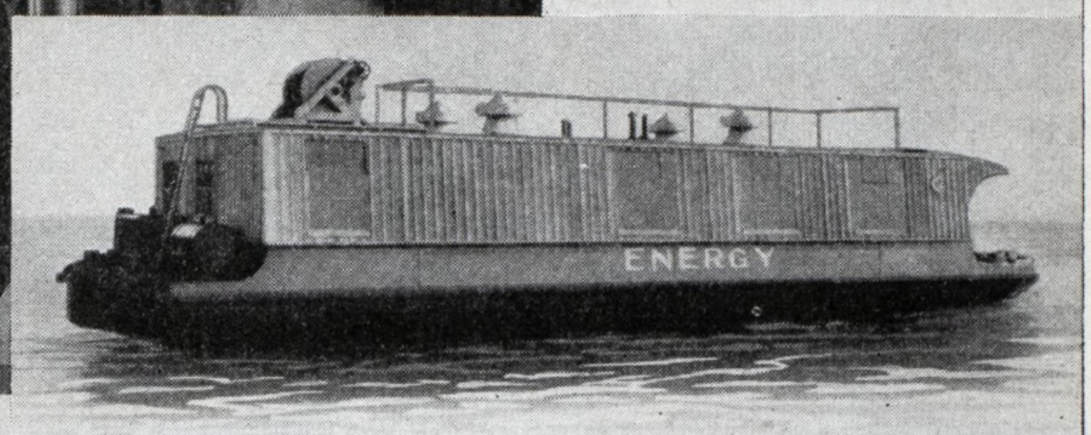
Charleston Dry Dock & Machine Company
Charleston, S. C.

Sole Licensees for Smith System—Correspondence invited with Shipyards desiring to construct Vessels on this System —Reasonable Royalties.

A Floating Diesel Power Plant



The pair of Cooper-Bessemer 240 H. P. diesel engines which direct drive two 175 K. W. electric generators in the steel barge "Energy."



DIESEL-ELECTRIC power where you want it — on river, bay or water front. A power plant which is safe, portable, economical and dependable is illustrated in the installation pictured above.

This portable floating power plant is owned by The Texas Company, and supplies electricity for rotary drilling in the shallow water oil fields of Louisiana. The use of diesel-electric power has eliminated several serious handicaps in tidewater oil well drilling.

Whether for work boat propulsion or power plant service, Cooper-Bessemer diesel engines have proved their ability to give complete satisfaction. A representative from one of the offices listed below will be glad to give you information.

THE COOPER-BESSEMER CORPORATION
GENERAL DIESEL SALES OFFICES: SUITE 301, 25 W. 3rd ST., NEW YORK CITY
131 State St., *Boston, Mass.* 505 Esperson Bldg., *Houston, Texas* 640 E. 61st St., *Los Angeles, Calif.*
PLANTS: MOUNT VERNON, OHIO GROVE CITY, PENNSYLVANIA

COOPER-BESSEMER

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85 Liberty St., New York City.

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Taylor Instrument Co's.,
90 Ames St., Rochester, N. Y.

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Morse, Andrew J., & Son, Inc.,
221 High St., Boston, Mass.

BABBITT METAL

Westinghouse Electric & Mfg. Co.,
S. Philadelphia, Pa.

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American Bridge Co., 71 Broadway, New York City.
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Goodrich, B. F., Rubber Co.,
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Ritchie, E. S., & Sons,
Brookline, Mass.

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Great Lakes Engineering Works,
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Newport News Shipbuilding & Dry Dock Co., 90 Broad St.,
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Oldman-Magee Boiler Works, Inc.,
36-40 Illinois St., Buffalo, N. Y.
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BURNERS (Oil)—See OIL BURNING EQUIPMENT

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New York City.
Standard Motor Construction Co.,
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Jersey City, N. J.

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DIESEL FUEL OIL—See FUEL OIL

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Maryland Dry Dock Co.,
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New York Shipbuilding Co.,
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McIntosh & Seymour Corp.,
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Sun Shipbuilding & Dry Dock Co.,
Chester, Pa.

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Jersey City, N. J.

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Cooper-Bessemer Corp., The,
Mt. Vernon, Ohio.
McIntosh & Seymour Corp.,
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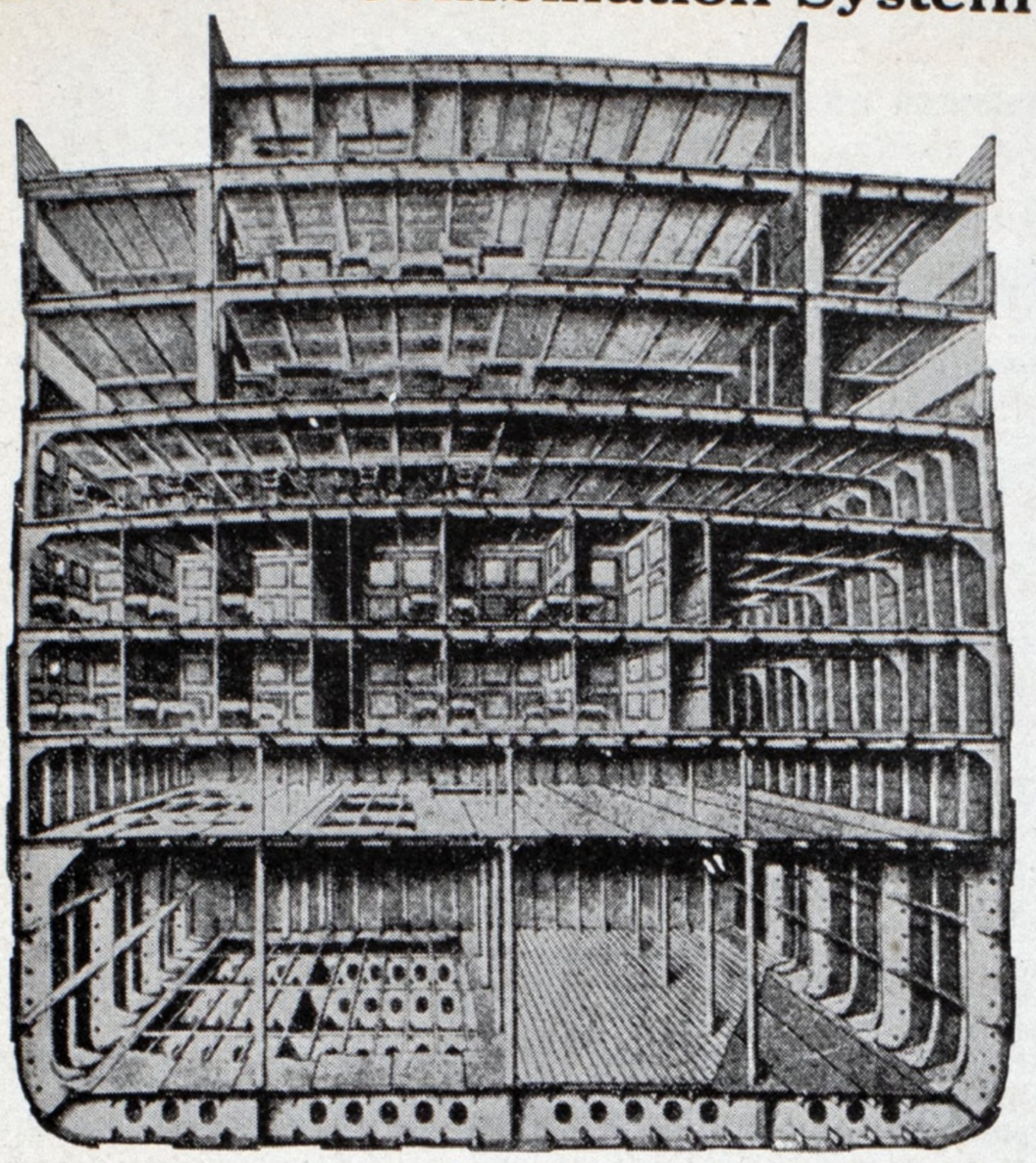

Sectional View of Interior of Passenger Liner designed on the Isherwood Combination System

(In a vessel of this type, deep transverses are recommended for hold construction, but are not essential.)

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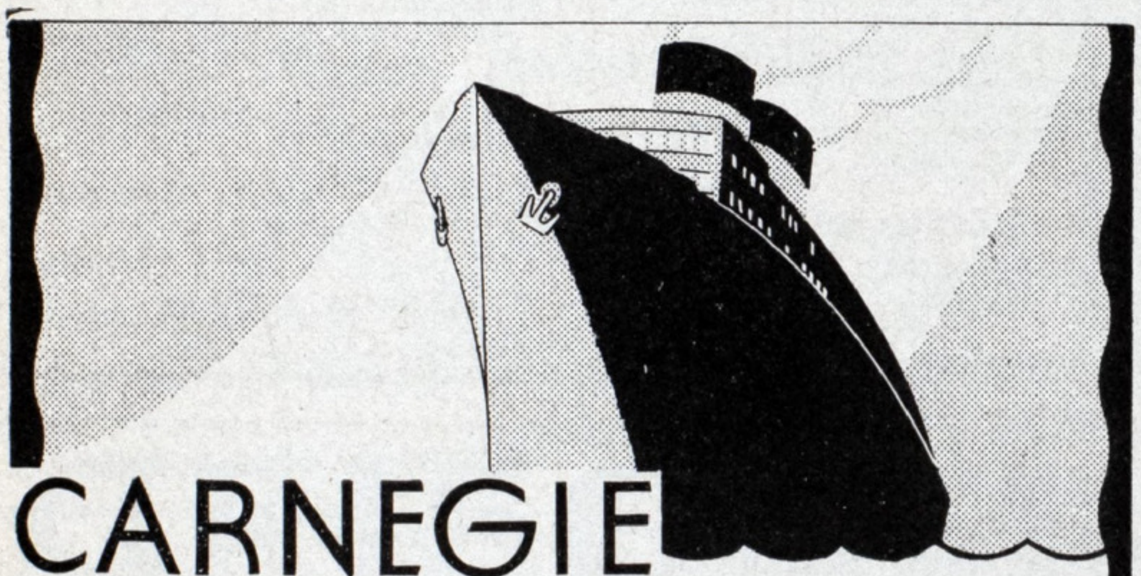

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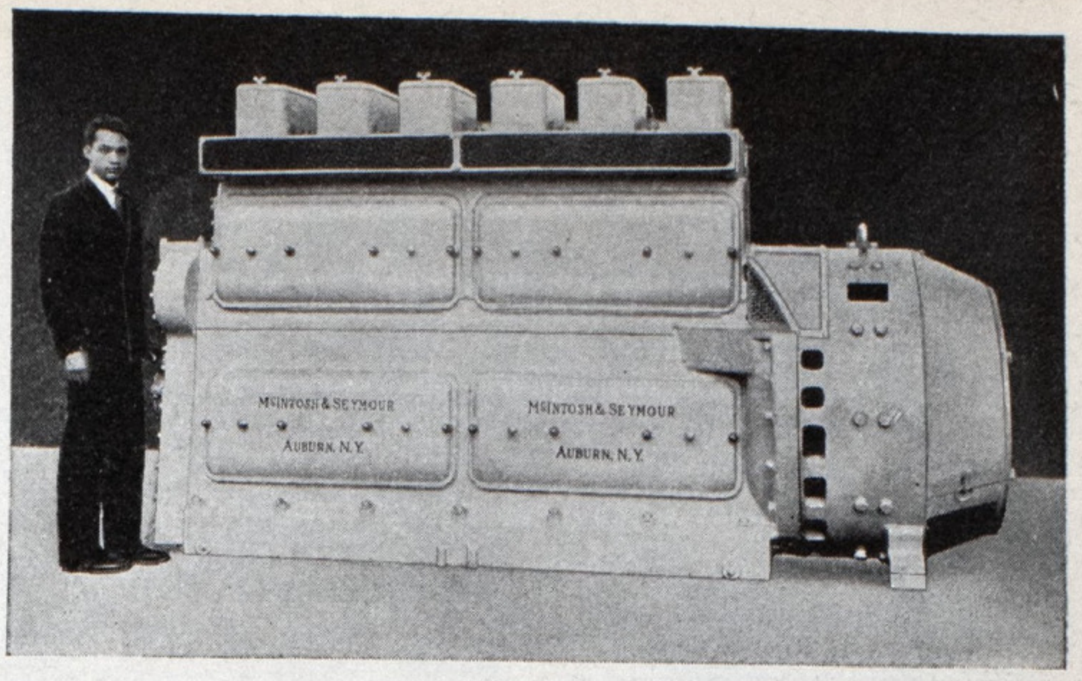

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United Dry Docks Inc., 11 Broadway, New York City.

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Westinghouse Electric & Mfg. Co., S. Philadelphia, Pa.

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Babcock & Wilcox Co., The, 85 Liberty St., New York City.

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Samson Cordage Works, Boston.
Whitlock Cordage Co., 46 South St., New York City.

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Superior Mfg. Co., The, Gregg St., Carnegie, Pa.

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Griscom-Russell Co., 285 Madison Ave., New York City.
Westinghouse Electric & Mfg. Co., So. Philadelphia, Pa.

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Westinghouse Electric & Mfg. Co., S. Philadelphia, Pa.

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Stamford Foundry Co., Stamford, Conn.

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Hyde Windlass Co., Bath, Me.

HOISTS (Air)

American Shipbuilding Co., Foot of W. 54th St., Cleveland.

ICE MACHINES—See REFRIGERATING MACHINERY

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Sperry Gyroscope Co., The, Brooklyn, N. Y.

INDICATORS (Helm Angle)

Sperry Gyroscope Co., The, Brooklyn, N. Y.

INDICATORS (Speed)

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Sperry Gyroscope Co., The, Brooklyn, N. Y.

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Boland & Cornelius, Marine Trust Bldg., Buffalo, N. Y.

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Lane, C. M., Lifeboat Co., Inc., 856 Humboldt St., Brooklyn, N. Y.

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Westinghouse Electric & Mfg. Co., S. Philadelphia, Pa.

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MACHINERY (Marine)

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Great Lakes Engineering Works, River Rouge, Mich.
Manitowoc Ship Building Corp., Manitowoc, Wis.
Maryland Dry Dock Co., Baltimore, Md.

MACHINES (Sounding)

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METERS (Gas & Air)

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MOTORS

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Troy Engine & Machine Co., Troy, Pa.
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NAUTICAL INSTRUMENTS

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PUMPS (Steam)

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323 W. 10th St., Indianapolis, Ind.

PUMPS (Vacuum)

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Charleston, S. C.
Chicago Shipbuilding Co.,
So. Chicago, Ill.
Federal Shipbuilding & Dry Dock Co., Lincoln Highway, Kearney, N. J.
Great Lakes Engineering Works,
River Rouge, Mich.
Manitowoc Ship Building Corp.,
Manitowoc, Wis.
Newport News Shipbuilding & Dry Dock Co., 90 Broad St.,
New York City.
New York Shipbuilding Co.,
Camden, N. J.
Sun Shipbuilding & Dry Dock Co.,
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United Dry Docks, Inc.,
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Great Lakes Engineering Works,
River Rouge, Mich.
Manitowoc Ship Building Corp.,
Manitowoc, Wis.
Maryland Dry Dock Co.,
Baltimore, Md.
Newport News Shipbuilding & Dry Dock Co., 90 Broad St.,
New York City.
New York Shipbuilding Co.,
Camden, N. J.
Sun Shipbuilding & Dry Dock Co.,
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Todd Shipyards Corp.,
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New Brunswick, N. J.

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SUPERHEATERS

Babcock & Wilcox Co., The,
85 Liberty St., New York City.

SWITCHBOARDS

General Electric Co.,
Schenectady, N. Y.
Troy Engine & Machine Co.,
Troy, Pa.
Westinghouse Electric & Mfg. Co.,
S. Philadelphia, Pa.

TELEGRAPH (Electrical, Mechanical)

Cory, Chas., Corp.,
68 King St., New York City.

TELEMOTORS

Hyde Windlass Co., Bath, Me.

TELEPHONE SYSTEMS

Cory, Chas., Corp.,
68 King St., New York City.

THERMOMETERS (Temperature, Recording)

Taylor Instrument Co's.,
90 Ames St., Rochester, N. Y.

TOWING LINES

Columbian Rope Co., Auburn, N. Y.
Whitlock Cordage Co.,
46 South St., New York City.

TRACTORS

Clark Tructractor Co.,
Battle Creek, Mich.
Elwell-Parker Electric Co., The,
4205 St. Clair Ave., Cleveland, O.

TRANSMISSION (Rope)—See ROPE (Transmission)

TRUCKS

Clark Tructractor Co.,
Battle Creek, Mich.
Elwell-Parker Electric Co., The,
4205 St. Clair Ave., Cleveland, O.

TRUCKS (Dump)

Clark Tructractor Co.,
Battle Creek, Mich.

TURBINES (Electric)

Westinghouse Electric & Mfg. Co.,
So. Philadelphia, Pa.

TURBINES (Marine)

Federal Shipbuilding & Dry Dock Co., Lincoln Highway, Kearney, N. J.
General Electric Co.,
Schenectady, N. Y.
Newport News Shipbuilding & Dry Dock Co., 90 Broad St.,
New York City.
Westinghouse Electric & Mfg. Co.,
So. Philadelphia, Pa.

TURBINES (Steam)

DeLaval Steam Turbine Co.,
Trenton, N. J.
General Electric Co.,
Schenectady, N. Y.
Newport News Shipbuilding & Dry Dock Co., 90 Broad St.,
New York City.
Sturtevant, B. F., Co.,
Hyde Park, Boston, Mass.
Westinghouse Electric & Mfg. Co.,
So. Philadelphia, Pa.

TWINE AND ROPE

Columbian Rope Co., Auburn, N. Y.
Samson Cordage Works, Boston.
Whitlock Cordage Co.,
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VENTILATING EQUIPMENT

Sturtevant, B. F., Co.,
Hyde Park, Boston, Mass.

VENTILATORS

Allen Corp.,
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WATER COOLERS

General Electric Co.,
Schenectady, N. Y.

WATER PURIFICATION SYSTEMS

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Schenectady, N. Y.
Westinghouse Electric & Mfg. Co.,
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WHISTLES

Star Brass Mfg. Co.,
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WINCHES

Dake Engine Co.,
Grand Haven, Mich.
Hyde Windlass Co., Bath, Me.

WINDLASSES

American Shipbuilding Co.,
Foot of W. 54th St., Cleveland.
Dake Engine Co.,
Grand Haven, Mich.
Hyde Windlass Co., Bath, Me.

WINDOWS (Balanced Frameless)

Kearfoot Engineering Co.,
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WORKBOATS

Lane, C. M., Lifeboat Co., Inc.,
856 Humboldt St., Brooklyn.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above

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MARINE PUMPS

"The Dean of Pumps on Land and Sea"

Single Style & Duplex
Piston Type & Plunger

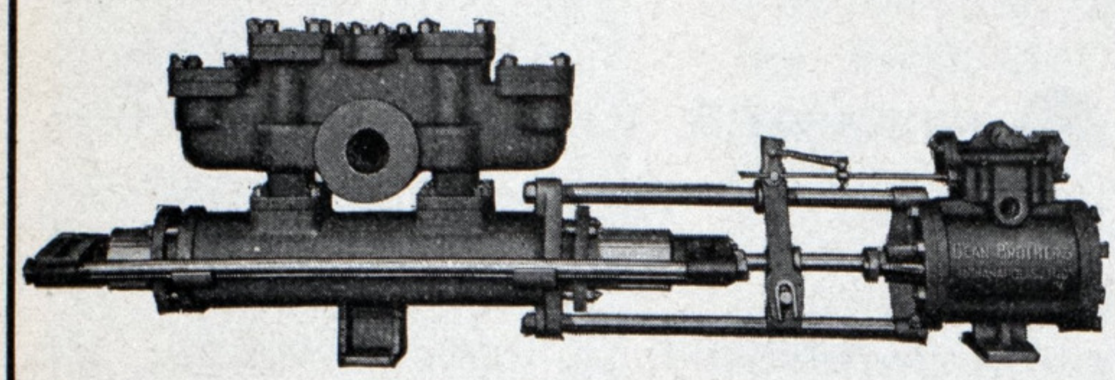

Figure No. 2311 Horizontal Single Style Double Acting Outside End Packed Plunger Trombone Pot Valve Pump For Boiler Feed & Pressure Service.

ESTABLISHED 1869

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to fit any hub.

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Navigational Equipment
Contracts a Specialty

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Accurate "Non-corrosive" Pressure and Recording Gauges, Revolution Counters, Marine Clocks.

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Marine, Safety and Relief Valves for all pressures.

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Extra Heavy Renewable Globe, Angle and Check Valves.

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FIBORE
(FIBRE CORE)

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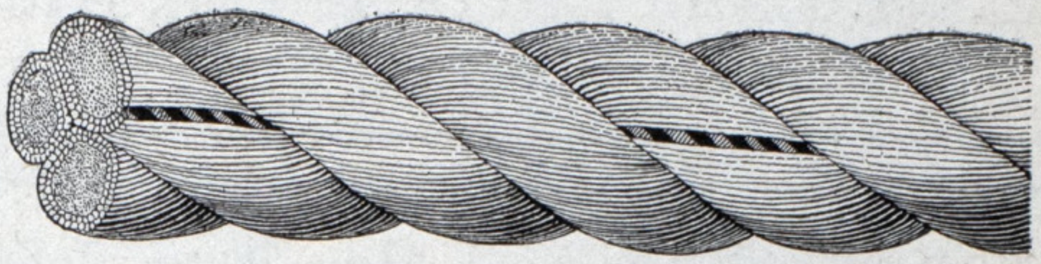

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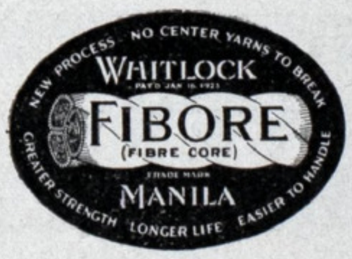

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New York

Factory and Warehouses
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Branches
Chicago, Boston, Kansas City *and* Houston

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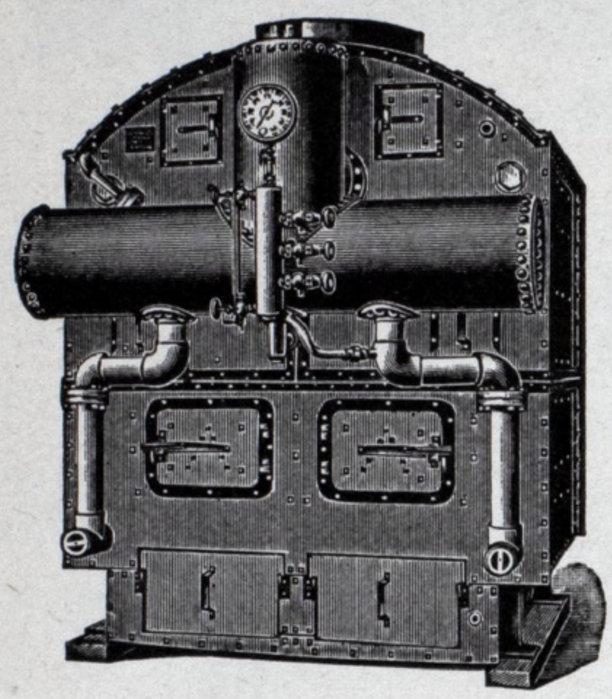
WERE SUPPLIED TO THE

BYRD ANTARCTIC EXPEDITION

C. M. Lane Lifeboat Co., Inc.
Brooklyn, N. Y.



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Almy Water Tube Boiler Co.

Builders of Sectional Water Tube Boilers for all types of vessels

Providence, R. I. U. S. A.

FOR Sale-

● STEAMER VEEDOL, 12,000 barrels, Coastwise Tanker; 228' 6" x 37' 6"; draft 15'; 4 tanks subdivided; pump-room amidships; 2 Scotch boilers; 600 H.P. triple engine; speed 9 knots; consumption 60 bbls. per day; built 1920; excellent condition. Reply . . .

TIDE WATER
OIL COMPANY
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Please have remittance accompany order.

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AT LIBERTY FOR COMING SEASON. First class steward, all around cook. On the Great Lakes since 1905. Go anywhere. Wife and waitress. Bill DePuy, Elk's Club, Tulsa, Okla.

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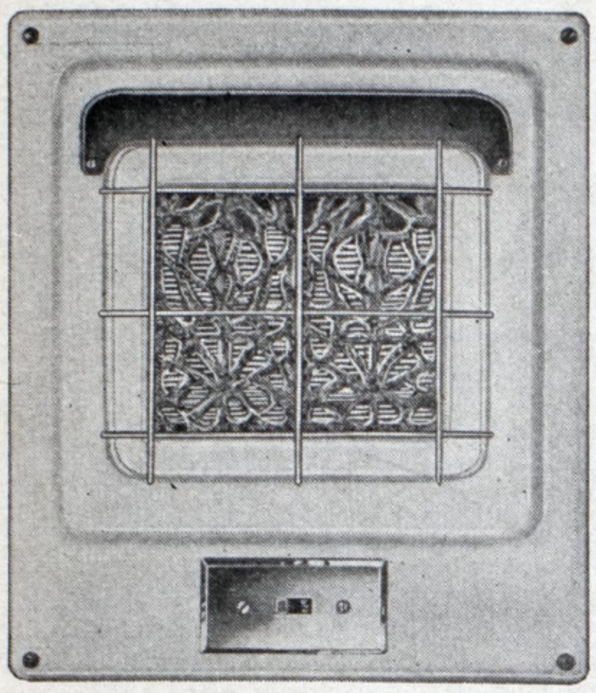
FOR SALE
WOODEN TOW BARGE PESHTIGO
201' Keel 37' Beam 12' Depth.
O. W. Blodgett, Bay City, Mich.

FOR SALE: 12" SUCTION DREDGE, 72 FT. ladder, and agitator, dredge 40 ft. deep. Canal Barge 115' x 22" Cap. 500 tons. W. J. Hingston, 86 Springville Avenue, Buffalo, N. Y.

FOR SALE
WOODEN TOW BARGE N. C. HOLLAND
187' Keel 32' Beam 11' 2" Depth.
O. W. Blodgett, Bay City, Mich.

GIVE YOUR PASSENGERS AS MUCH HEAT AS THEY WANT - - - - - WHEN THEY WANT IT



Model 102A — Volts 110 — Rating 1000 Watts
Frame: 14″ Wide—16¼″ High
Body: 11¾″ Wide—11¾″ High—4″ Deep

Give your passengers a comfortable trip that they'll rave about to their friends. It will be good advertising for your line. The RADIANT ELECTRIC HEATER enables passengers to control the heat in their staterooms to their liking—gives a glow of real hospitality.

Economical to install. Furnished in various color combinations. Costs just a few cents an hour for current.

Write for Full Details — Now!

The RADIANT ELECTRIC HEATER

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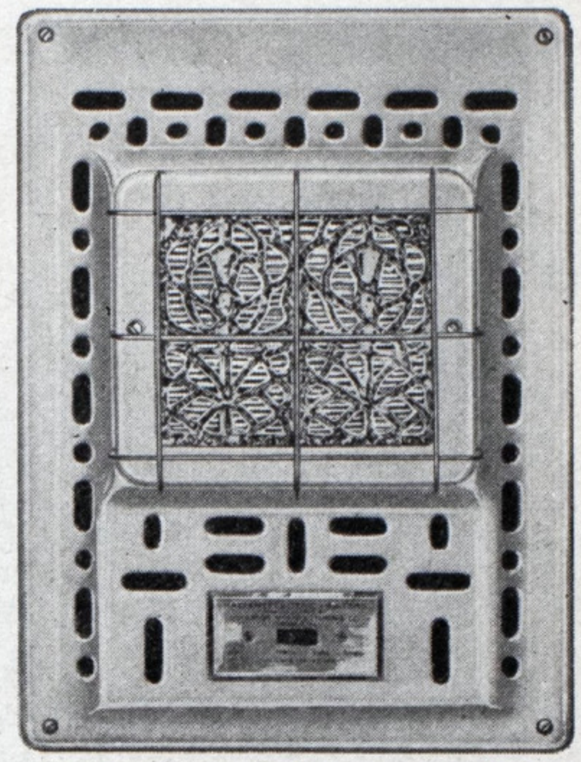

Model 102B — Volts 110 — Rating 1200 Watts
Frame: 14⅜″ Wide—19½″ High
Body: 12⅜″ Wide—17½″ High—4″ Deep

SUPERIOR MANUFACTURING COMPANY
Carnegie, Pennsylvania

Edward P. Farley & Co.
Incorporated
Steamship Owners, Agents and Brokers
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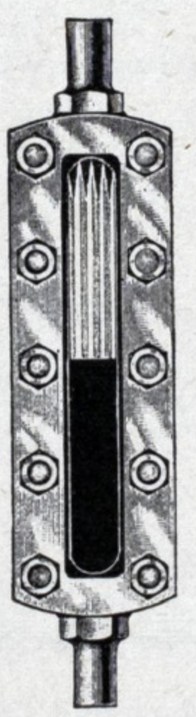
John J. Boland — **Adam E. Cornelius**

BOLAND & CORNELIUS
VESSEL OWNERS AND BROKERS
Marine Insurance Agents
Marine Trust Building BUFFALO, N. Y.



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Used on all types of boilers by all the Principal Navies of the world

"The Water Shows Black"

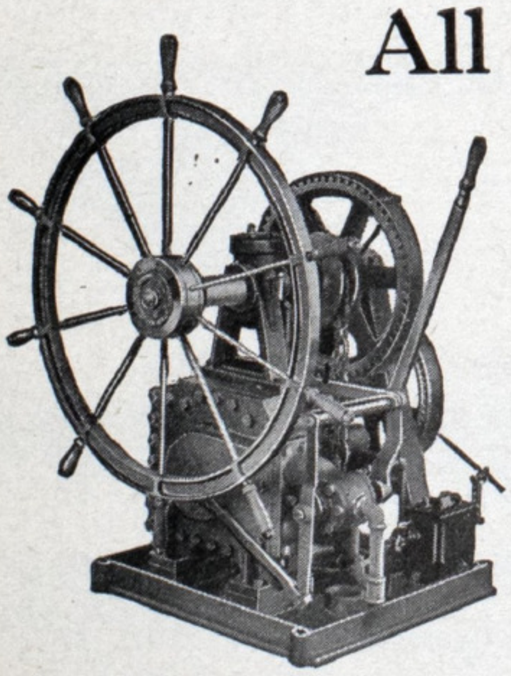
ADVANTAGES: Quick and reliable observation of the water level. Safe, sure and durable at high pressure. Not affected by cold air drafts. Most effective protection against injuries to boilers and workmen. Easily applied to all types of gage glass fittings.

When filled with **WATER** the Reflex Gage always appears **BLACK**. When empty it instantly shows **WHITE.** No mistake possible. This feature alone is worth many times the cost of the Reflex.

Send for catalog of Water Gage Apparatus

MANUFACTURED BY THE
JERGUSON GAGE & VALVE CO.
WINTER HILL, SOMERVILLE, MASS.

All Over the Lakes They're Using Dake's

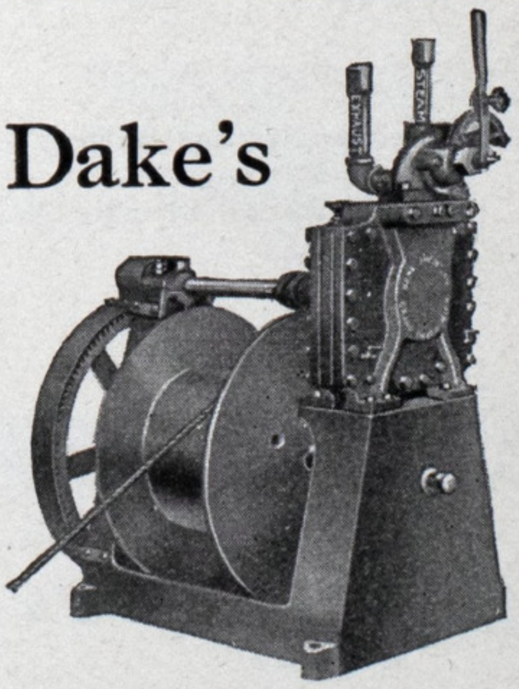


"CS" Steering Gear

Go into any port of consequence on the Great Lakes and you will find vessels using DAKE Steering Gears, Capstans, Windlasses or other auxiliaries. Ask the owners and you will find they give efficient dependable service, with the least expense for upkeep. DAKE Auxiliaries are all simple of construction and very compact. They require less space and very little attention. Write for information on any auxiliaries you are interested in.

Steering Gears, Capstans (hand and steam) Anchor Windlasses, Stage Hoists, Snub Line Winches, Spud Lifters, Net Lifters and Marine Castings.

Dake Engine Co., GRAND HAVEN, MICHIGAN



Snub Line Winch

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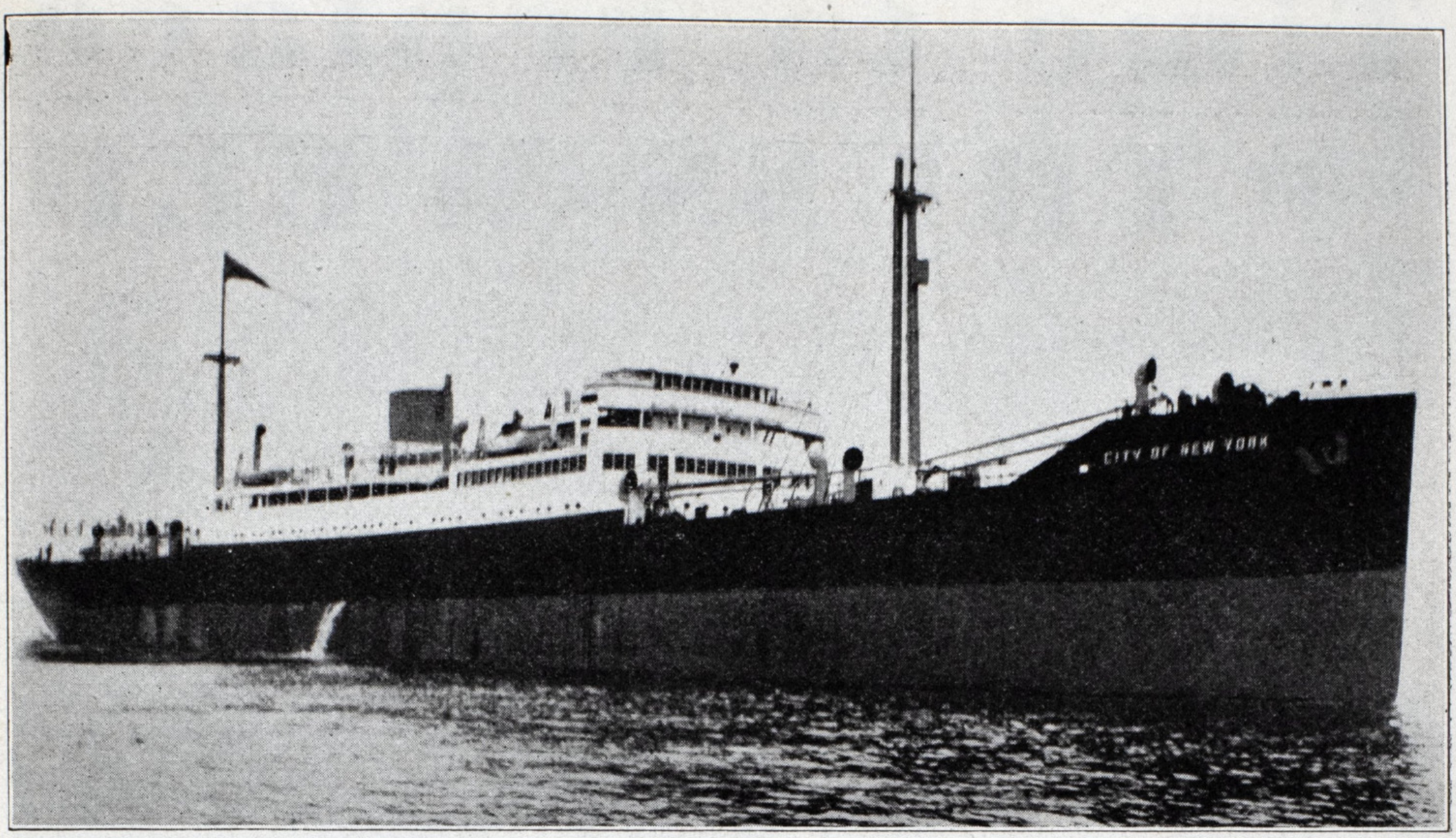
Driven by Sun-Doxford Engines



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East Indian (twin screw)	5,000	11,600
Henry Ford II	3,300	12,000
Twin Screw Yacht Sialia	1,500	

MOTORTANKERS	h.p.	d.w.t.
Aurora	3,000	10,200
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Bidwell	3,000	10,200
Chester Sun	2,800	13,452
Eastern Sun	3,000	13,500
Gulf of Venezuela	3,000	10,200
Pacific Sun	3,000	13,500
Sun	3,000	13,500
Sunoil	3,000	13,500
Tide Water	3,000	13,800
Tide Water Associated	3,000	13,800
Western Sun	3,000	13,500

Builders of

Passenger and Cargo Vessels—Oil Tankers

Unlimited facilities for

MARINE REPAIRS

Two floating Dry Docks
11,000 Tons Lifting Capacity Each

SUN SHIPBUILDING & DRY DOCK COMPANY

Shipyard & Main Office
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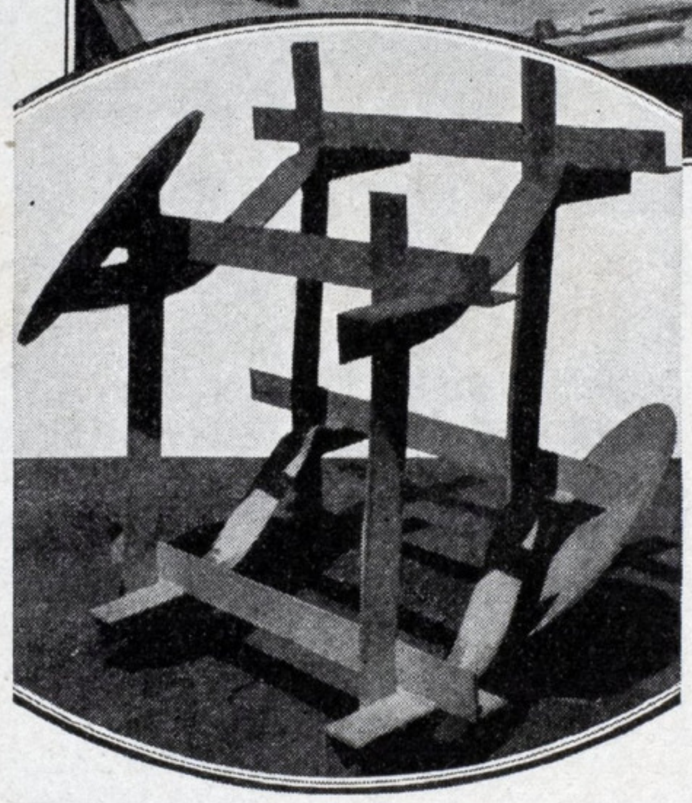
Time to replace *with* TRUSS-WELD

FALSE economy is keeping worn-out floating equipment in operation. Replacement with TRUSS-WELD construction would lower operating cost, maintenance and depreciation—at low initial cost—and prove real economy.

Less power is required for propelling or towing TRUSS-WELD vessels because they have appreciably greater carrying capacity for their displacement—a saving immediately evident in operating cost.

Strength and rigidity of hull construction reduce the necessity for repairs and are establishing low records for cost of maintenance and depreciation.

The superiority of TRUSS-WELD over other systems of steel construction suggests that ship operators survey units whose operating, maintenance and depreciation costs are high and consider replacing them at once with TRUSS-WELD.



This small picture tells a big story. Here we have a typical TRUSS-WELD "cell," tested to destruction under an increasing load. Applied in a diagonal direction, the load amounted to ten tons before any deflection of the truss members was noted. Thereafter, as the load was increased, the deflection continued until fractures occurred in the truss members—but not a single fracture occurred in the welds. In a barge 116′ x 36′ x 10′ there are approximately 2,000 such "cells" to resist hull distortion.

Carries Liquid Cargoes or Heavy Deck Loads

The TRUSS-WELD ship carries liquid cargoes or heavy deck loads. It is *trussed* and *welded*, and built to stand hard usage. Angle iron truss members run longitudinally, athwartship and vertically and are electrically welded to each other at all intersections and to the skin of the hull, making a single-acting structural unit to absorb and dissipate any shock applied to the hull.

The structure is composed of a great number of "cells," formed by the truss members. Pressure applied to any "cell" is transmitted to adjacent "cells" and from them to their adjacent "cells" until the pressure is dissipated. TRUSS-WELD is the strongest and most rigid hull construction yet devised.

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INCORPORATED

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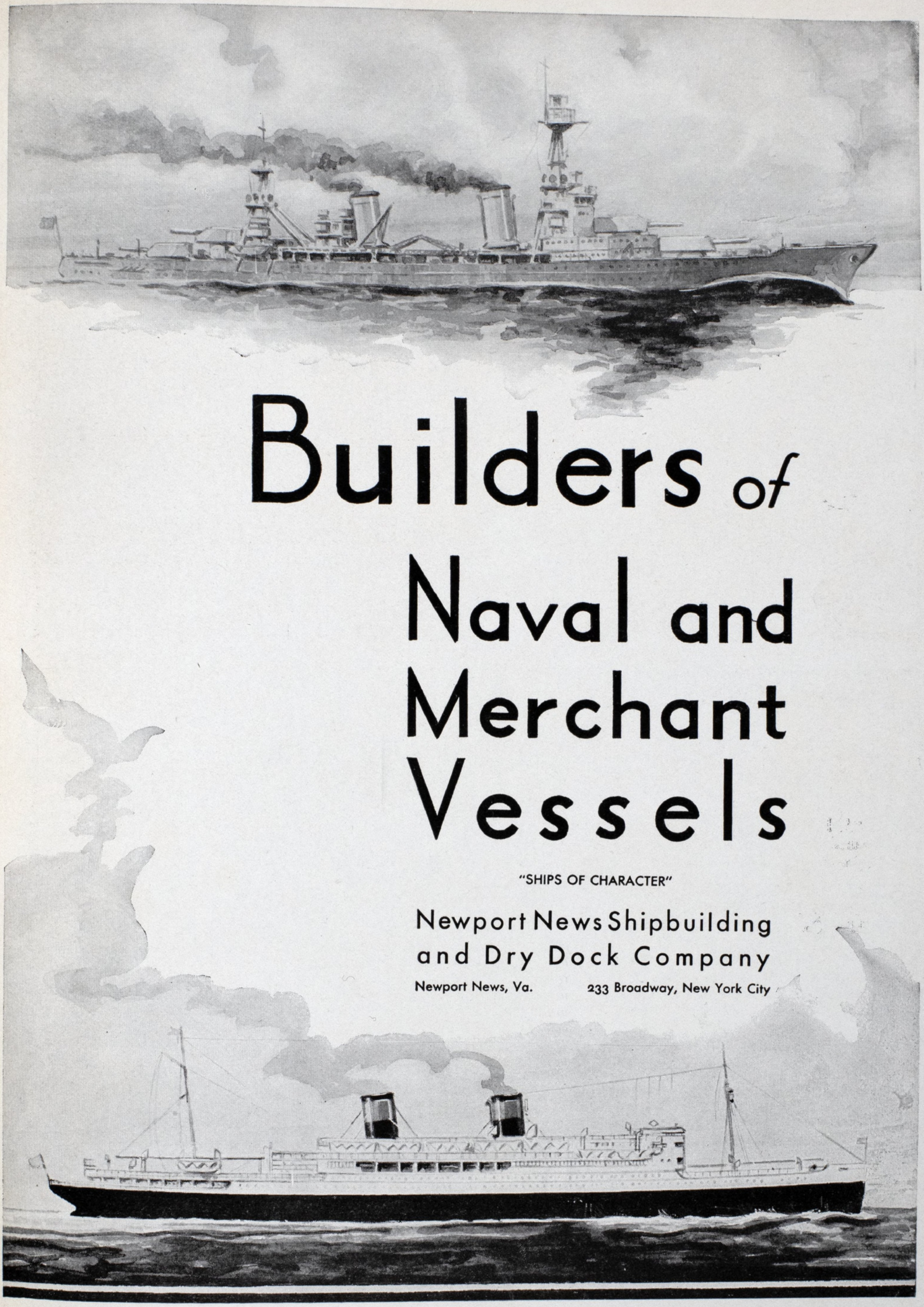

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"SHIPS OF CHARACTER"

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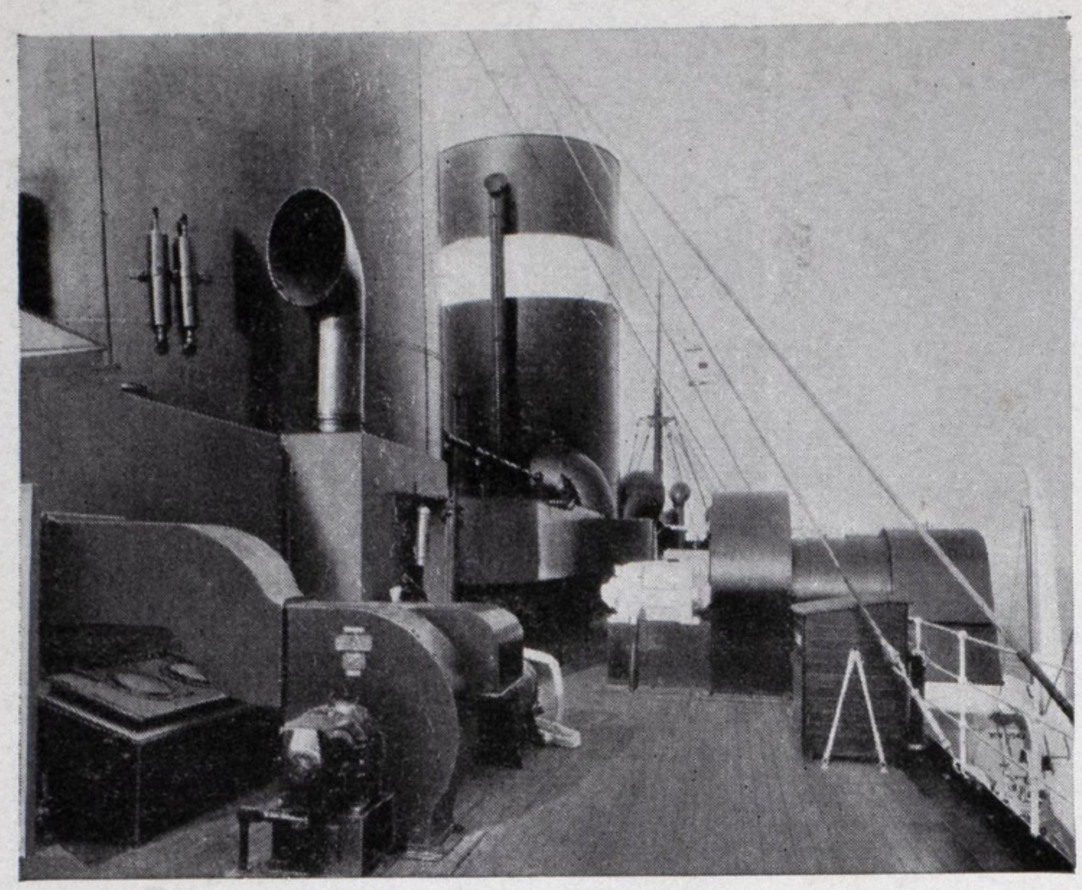

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When your passengers get up in the morning are they refreshed from a good night's sleep? If they have been sleeping on the boats equipped with Sturtevant ventilating fan, the chances are that the fresh cool sea air has filled them with new zest and vigor.

Sturtevant Ventilating equipment has been the standard by which all other systems have been measured for over fifty years. They are both quiet and efficient. We put into them the experience gained from sixty-six years of building air handling equipment.

A request will bring you complete information on this very important subject of marine ventilation.

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Heating and Ventilating Equipment—

Mechanical Draft Equipment—Turbines—Motors—Blowers—

Ventilating Sets—Heaters—Generating Sets—Exhausters

Gasoline and Steam Engines

If You Want The Best Specify

Hyde

S. S. "A. F. HARVEY" owned by Pittsburgh Steamship Co. and built by Great Lakes Engineering Works.

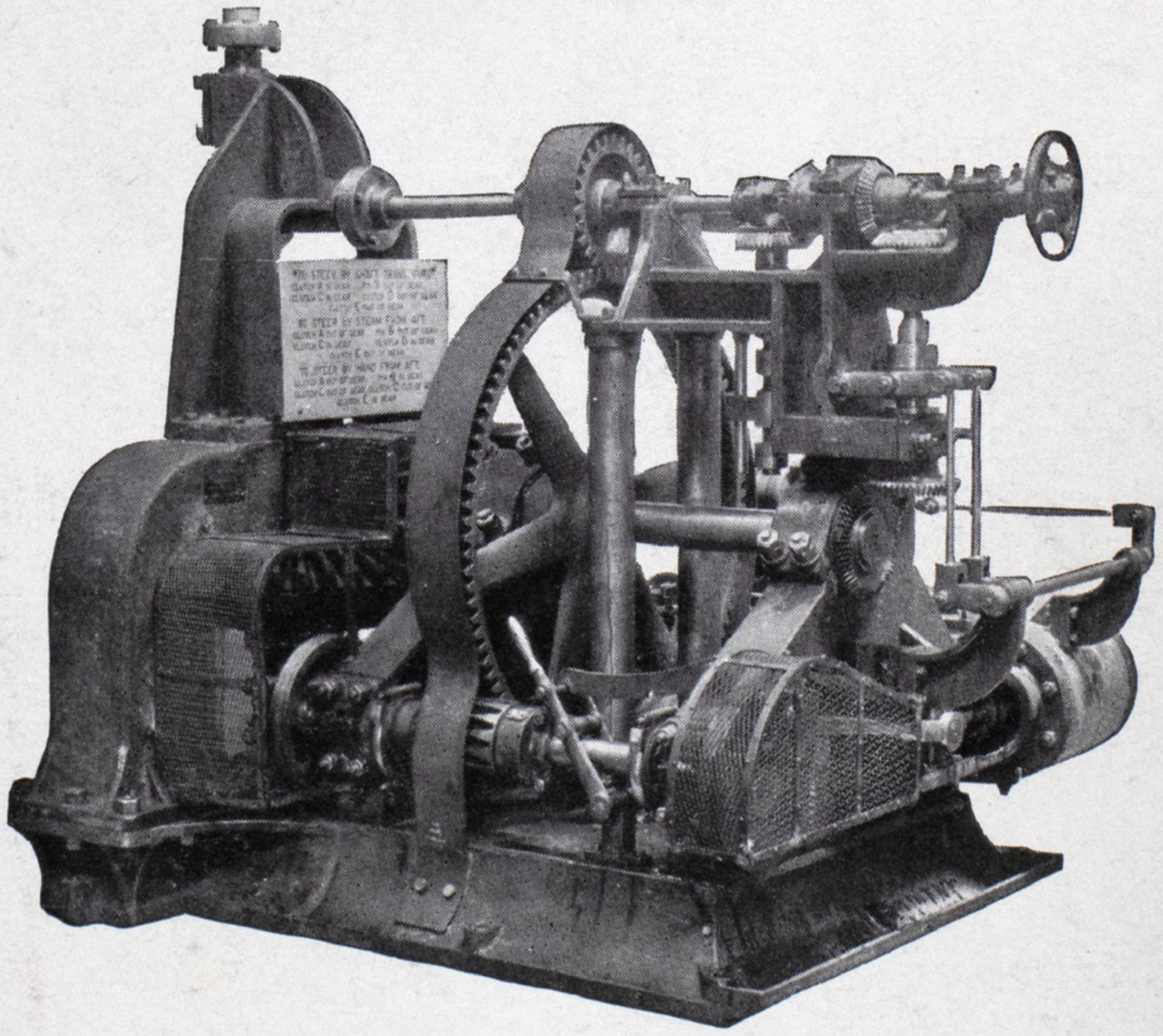
S. S. "B. F. AFFLECK" owned by Pittsburgh Steamship Co. and built by Toledo Shipbuilding Co.

S. S. "S. T. Crapo" owned by Huron Transportation Co. and built by Great Lakes Engineering Works.

These three fine new boats are all equipped with

Hyde

Quadrant Type Steering Gear
Spur Gear Windlass
Mooring Winches
Hatch Winches



HYDE Quadrant Type Steering Gear

Hyde Windlass Company

Bath, Maine